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2004 Evaluation of 4VWX Herring

Évaluation des stocks de hareng dans 4VWX en 2004

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ABSTRACT

Landings in the southwest Nova Scotia/Bay of Fundy spawning component in 2003 (89,360t) were 12,000t higher than the previous year and the highest since 1993. Acoustic surveys in 2003 continued to show a spawning stock biomass (SSB) of approximately 500,000t but there has been deterioration in the state of the stock. The 2003 catch was dominated by age 2 (by number) and 3 (by weight) and there is an absence of old fish in the population, with increased targeting of juveniles by the fishery. SSB on both Trinity Ledge and Seal Island spawning areas remain well below historical levels. While recent catches have been consistent with the survey, assess, fish protocol of less than 20% of surveyed biomass, catch at age and the rapid decline of year-classes indicates that total mortality may be considerably higher. There has been insufficient progress towards defined conservation objectives in recent years.

Landings for 2003 in the offshore Scotian Shelf banks spawning component (less than 1,000t) were the smallest since the fishery was reactivated in 1996. The 2003 fishery was dominated by the 1998 year-class (age 5). However, bottom trawl research survey catches of the past six years have been the highest on record and herring were widely distributed on banks west of Sable Island.

Biomass estimates from acoustic surveys of the major coastal Nova Scotia spawning components were higher for all surveyed areas in 2003 with large increases for the Little Hope, Eastern Shore and Glace Bay areas. The Bras d'Or lakes fishery was closed in 2003 with only research gillnet sampling to document the age distribution.

There was a further drop in landings in the traditional New Brunswick weir and shutoff juvenile herring fishery to 9000t – the lowest since 1983.

RÉSUMÉ

En 2003, les débarquements de reproducteurs capturés dans le secteur sud-ouest de la Nouvelle-Écosse/baie de Fundy se sont chiffrés à 89 360 tonnes, soit 12 000 t de plus que l'année précédente, un sommet depuis 1993. D'après les relevés acoustiques effectués en 2003, la biomasse du stock reproducteur se chiffre encore à environ 500 000 t, mais l'état du stock s'est détérioré. Les prises de 2003 comprenaient principalement des poissons de 2 ans (en nombre) et de 3 ans (en poids). La population de harengs ne compte aucun vieux poisson puisque les juvéniles sont de plus en plus ciblés par la pêche. La biomasse du stock reproducteur dans les frayères du récif de la Trinité et de l'île Seal demeure très inférieure à ses niveaux historiques. Quoique les prises récentes aient été conformes au protocole de relevé, d'évaluation et d'exploitation de moins de 20 % de la biomasse observée dans le relevé, les prises selon l'âge et la baisse rapide de l'effectif des classes d'âge révèlent que la mortalité totale pourrait être considérablement plus élevée. Au cours des dernières années, les progrès vers les objectifs de conservation ont été insuffisants.

En 2003, les débarquements de reproducteurs capturés sur les bancs du large du plateau néo-écossais se sont chiffrés à moins de 1 000 t, le plus bas niveau depuis la réouverture de la pêche en 1996. Les prises de 2003 comprenaient principalement des harengs de 5 ans (classe d'âge de 1998). Cependant, dans les relevés de recherche au chalut de fond des six dernières années, les prises ont atteint des sommets records et le hareng était très répandu sur les bancs situés à l'ouest de l'île de Sable.

Les estimations de la biomasse effectuées à partir des résultats des relevés acoustiques des principaux groupes de reproducteurs des côtes de la Nouvelle-Écosse ont été plus élevées pour chacune des zones ayant fait l'objet d'un relevé en 2003, des hausses importantes ayant été enregistrées dans les secteurs de Little Hope, Eastern Shore et de Glace Bay. La pêche dans les lacs Bras d'Or a été fermée en 2003, et la distribution des âges n'a pu être établie que d'après les résultats d'échantillonnages au filet maillant.

Au Nouveau-Brunswick, les débarquements de la pêche traditionnelle de harengs juvéniles à la fascine et à la senne de plage ont encore chuté pour se chiffrer à 9 000 t, le plus bas niveau depuis 1983.

2004 Evaluation of 4VWX Herring

Introduction

Atlantic herring is a pelagic species found on both sides of the North Atlantic. Herring spawn in discrete locations, to which they are presumed to home. Herring first mature and spawn at three or four years of age (23 to 28 cm or 9 to 11 in), then begin a predictable annual pattern of spawning, overwintering, and summer feeding, which often involves considerable migration and mixing with members of other spawning groups. Most fishing takes place on dense summer feeding, overwintering, and spawning aggregations.

The 4VWX management unit contains a number of spawning areas, separated to various degrees in space and time. Spawning areas in close proximity with similar spawning times, and which share a larval distribution area, are considered part of the same complex. These undoubtedly have much closer affinity than spawning areas that are widely separated in space or time, and do not share a common larval distribution. Some spawning areas are large and offshore, whereas others are small and more localized, sometimes very near shore or in small embayments. The situation is complicated further as herring migrate long distances and mix outside of the spawning period both with members considered part of the same complex and with members of other spawning groups. For the purposes of evaluation and management, the 4VWX herring fisheries are divided into four components (Fig. 1):

1. SW Nova Scotia/Bay of Fundy spawning component
2. Offshore Scotian Shelf banks spawning component
3. Coastal (South Shore, Eastern Shore and Cape Breton) Nova Scotia spawning component; and
4. SW New Brunswick migrant juveniles.

Each component has several spawning areas, and there is mixing of fish among spawning components. Industry and management have explored means of managing the complexity within each component (such as distributing fishing effort among spawning areas according to their relative size) and of taking appropriate account of interaction among components (such as fishing restrictions on some areas of mixing).

Fisheries in the 4VWX area in recent years have been dominated by purse seine, weir and gillnet, with relatively minor landings by shutoff, trap and midwater trawl (Table 1,2). In Sept. 2003 a new statistics recording system called MARFIS was implemented which resulted in a few data conversion and data entry problems for herring. In particular the landings for shutoff gear have not yet been incorporated to the entry system and so are still incomplete (Table 1).

Since 1995, the herring stock assessment and related research has been enhanced by a number of projects undertaken with the assistance of the fishing industry. These include industry sampling of biological characteristics of the catch, acoustic surveys using industry vessels and tagging.

The Georges Bank spawning component (Fig. 1) is not included in this evaluation except to document Canadian herring landings from that area (Table 1). This fishery is included in the Gulf of Maine stock complex and has been recently evaluated separately (DFO 2003a).

1) Objectives and Management

The 2003-2006 Scotia-Fundy Herring Integrated Fisheries Management Plan (DFO 2003b) sets out principles, conditions, and management measures for the 4VWX herring fisheries. The main principle stated in the plan is "the conservation of the herring resource and the preservation of all of its spawning components".

Three conservation objectives developed and reviewed by Sinclair (1997) appear in the plan:

1) To maintain the reproductive capacity of herring in each management unit through:

- persistence of all spawning components in the management unit;
- maintenance of biomass of each spawning component above a minimum threshold;
- maintenance of a broad age composition for each spawning component; and
- maintenance of a long spawning period for each spawning component.

2) To prevent growth overfishing:

- continue to strive for fishing mortality at or below F0.1

3) To maintain ecosystem integrity/ ecological relationships ("ecosystem balance").

- maintain spatial and temporal diversity of spawning
- maintain herring biomass at moderate to high levels

An "in-season" management process, first implemented in the southwest Nova Scotia fishery during 1995, continued to be used widely within the 4VWX management area (DFO 1997, Stephenson et al 1996,1999a). The approach encouraged surveying using the commercial fleet under scientific direction prior to fishing ("survey, assess, then fish" protocol) to ensure that effort was distributed appropriately among various components of the stock (particularly among spawning components) according to the relative size and current state of each component. The use of this approach in recent years has improved data collection

and enabled modifications to management decisions to be made with the involvement of participants and on the basis of up-to-date information.

Collaborative research efforts with the fishing industry have been important in recent years. A major portion of the herring industry (including the purse seine sector and major processors) forms the Herring Science Council (HSC), and some members of the fixed gear sector have undertaken a separate Joint Project Agreement with DFO to undertake collaborative scientific projects. The herring industry has continued to provide biological sampling and samples while the purse seine and gillnet sectors undertook key acoustic surveys. Under the auspices of the HSC a dedicated field biologist also takes part in initiatives such as tagging, summary of fleet activities (Appendix A), and analysis of acoustic records from fishing trips.

2) SW NOVA SCOTIA/BAY OF FUNDY SPAWNING COMPONENT

2.1 The Fishery

Herring fishing locations, NAFO unit areas used for catch and sample aggregation and fishing areas defined by groupings of 10 mile squares (i.e. 10 minute squares of latitude and longitude) are shown in Figures 2 to 5.

The 2003 catch limit for this component was 93,000t, an increase of 15,000t from the previous year (Table 3, Fig. 6). Eighty percent of the catch limit was initially allocated to the mobile gear sector and 20% to the fixed gear sector, as has been done historically. Transfer of quota to the mobile fleet occurred late in the season.

Total landings from this component in 2003 (89,360t) were 12,000t higher than the previous year, and the highest since 1993 (Table 3). Increased landings by the purse seine sector (88,000t) accounted for the increase, as landings by both the gillnet sector (440t) and the Nova Scotia weirs (920t) were similar to 2002.

The temporal and spatial distribution of the purse seine fishery was generally as expected compared to the recent decade (Table 4-5). The largest purse seine fisheries occurred on the German Bank and Scots Bay spawning grounds, and on summer feeding fish off Long Island, N.S. and around Grand Manan (Fig. 7). There were substantial increases in the 2003 landings from Scots Bay and off Long Island, NS. The Lurcher area, while small overall, experienced a drop in landings of about 5,800t from 2002.

During the 1970's and 1980's, a large fishery took place on over-wintering aggregations in Chedabucto Bay. In recent years however, there has been no fishing effort in this area as traditional vessels have been successfully fishing elsewhere. In some years there has been a small fishery on over-wintering herring

in January off Halifax Harbour (Chebucto Head), but the majority of the fall and winter herring landings for the past several years have come from the New Brunswick side of the Bay of Fundy (Fig. 8-10) and take place from Oct. to Feb. The summer purse seine fishery landings (Fig. 9) took places in the same areas as in previous years. A large part of the purse seine fishery was directed on the major spawning grounds in Scots Bay and on German Bank (Fig. 11, 12) where recent catches are primarily within the pre-defined acoustic survey areas (Melvin and Power 1999). The Trinity Ledge spawning ground which is still recovering is closed to purse seine gear from Aug. 15 to Sept. 15 but there were acoustic surveys followed by some catch (354t) by gillnet gear (Fig. 13).

A small drift gillnet fishery that took place in the traditional areas (in June on the Spectacle Buoy area and in Sept. on Trinity Ledge) landed only 440t (Fig 14). Additional catches by drift gillnet gear occurred in Sept. to Oct. in the Little Hope/Port Mouton spawning grounds. There were also set gillnet catches along the Eastern Shore to the east of Halifax and near Glace Bay in Cape Breton (Fig. 15).

Catches in the Nova Scotia weirs of 921t, although only a little lower than in 2002, were the third lowest in the 40 year record of landings from this fishery (Table 3; Fig. 16). The decrease has been attributed to problems in availability of fish to this fixed stationary gear as there were substantial catches by purse seine in the Long Island area on the Bay of Fundy side of Digby Neck. The seasonal timing of the Nova Scotia weir landings has shifted in the last 4 years with a higher proportion of landings now as late as Aug. and Sept. as compared with the traditional early fishery seen in May and June previously (Table 6). Catches in recent years for the Nova Scotia weirs have been highly variable and not as consistent in their amount or timing as in the previous decade. There has also been a decline in the total number of herring weirs and the catch per weir for the Nova Scotia weir fishery (Table 7).

Catch and Effort

In order to follow trends in the overall effort on specific fishing grounds the landings data was summarized for various areas. The number of days fished, the number of active boats fishing and the total catch was determined from the landings data. There was no available information on the number of nets fished or for soak time while fishing these nets and so Catch per Unit Effort (CPUE) was calculated as catch per day and catch per boat for this analysis.

Overall gillnet landings in the Spectacle Buoy area which take place on spawning fish in the month of June were reduced in 2004 with only 11 days fished and 69t landed (Table 8, Figure 17). However, catch per day and catch per boat were higher than recent years for the few days the fishery took place.

Gillnet landings on the Trinity Ledge spawning grounds in the months of Aug. and Sept. have shown a general decline in the number of boats fishing and days fished in the last 3 years with catches up slightly to 369t in 2003 (Table 9, Figure 18). CPUE trends in catch per day and catch per boat also increased slightly in 2003.

Purse seine landings make up most of the overall catch and are allocated 80% of the TAC in the SW Nova Scotia/Bay of Fundy component under the current management plan. The purse seine catch has fluctuated between 60 and 100 thousand tones since 1989 with a steady increase in recent years reflecting increases in the TAC (Table 10, Figure 19). The overall number of boats fishing and days fished has been dropping since 1990 due to some fleet rationalizations. This has resulted in increases in catch per boat and catch per day in recent years.

2.2 Resource Status

Acoustic Surveys

Automated acoustic recording systems deployed on commercial fishing vessels were used to document the distribution and abundance of Atlantic herring in NAFO Division 4VWX through industry vessel surveys and fishing excursions (Melvin and Power 1999). Regularly scheduled surveys, at approximately 2-week intervals, were conducted on the main spawning components and the spawning stock biomass for each component was estimated by summing these results (Melvin et al 2004).

In 2003, four surveys were conducted in Scots Bay, three on Trinity Ledge and five on German Bank following established protocol and providing good coverage of these spawning areas consistent with previous years. Additional data from fishing nights in Scots Bay and German Bank were examined.

Biomass estimates for Scots Bay, Trinity Ledge and German Bank were approximately 133,900t, 14,500t, and 343,500t for a total surveyed SSB of 493,300t in the traditional survey areas (Table 11). Recorded biomass on German Bank was less than the previous year, but this is thought to have been due in part to an unusually long period (22 days) between two surveys. A single fishing night survey southeast of Seal Island observed 12,200t and there were 1,400t of spawning fish documented in the spring near Spectacle Buoy. Based on these surveys, the total SSB for the Bay of Fundy/SW Nova Scotia component of the 4WX herring complex in 2002 spawning season was approximately 500,000t. While this represents a slight decrease, it is not considered significantly different from 2002 (Melvin et al 2004).

There continues to be evidence of reappearance of spawning on the Seal Island grounds, but this area and Trinity Ledge remained well below historical levels.

Spawning ground turnover rates

The current acoustic survey method on spawning grounds is dependent on periodic turnover of spawning fish on the grounds. Acoustic surveys are required to be separated by at least 10 to 14 days to allow for turnover and to prevent double counting (Power et al 2002). This aspect of the assessment method was the subject of investigation in 2001 and of intensive sampling for maturity stage in the 2002 and 2003 fishing seasons. The results are summarized by Melvin et al. (2003, 2004) and were used to assist in the evaluation of turnover timing and the inclusion or exclusion of specific acoustic surveys.

Exploitation Rates on Spawning Grounds

An important utility of the acoustic surveys is the ability to estimate partial exploitation rates for spatially and temporally different spawning groups. If a large part of the total catch is taken from spawning groups that are surveyed then the partial exploitation rates will reflect almost all of the total exploitation. This is useful information for assessing the impact of fishing on individual spawning units as well as for the overall stock component (Table 12).

For this analysis only the three major spawning components Scots Bay, German Bank, Trinity Ledge that have received consistent survey effort were included (Table 12a). Since there are questions about comparability among years only data since 1997 are shown. Catches throughout the year from the spawning grounds were assumed to be site speci. while catches from all other areas were considered non-spawning and were allocated based on the relative spawning ground SSB amounts. In addition the SSB for Seal Island and Spectacle Buoy were allocated to the German Bank spawning area (Table 12b).

The exploitation rates were calculated for the overall adjusted catch by spawning ground both as proportions (Table12c) and as instantaneous fishing mortality rates (Table 12d).

Calculation of exploitation rates by component showed that the larger grounds (German Bank and Scots Bay) have a lower overall exploitation (F) of 0.08 to 0.28. Trinity Ledge had higher levels (0.18 to 1.39) but this may be a problem of both catch allocation and inconsistent survey effort over the period. The overall exploitation rate for the 4WX stock ranged for an F between 0.10 and 0.20, which are well below to slightly below the target of $F_{0.1}$ = 0.22.

Fleet Activity

A summary of daily fishery information compiled by the Herring Science Council and DFO confirmed that the fishery on this component was largely as expected in location and timing, and that there were substantial amounts of herring in some areas other than spawning grounds (Appendix 1). There has been an increase in

market for juvenile herring for both lobster bait and to offset a shortfall in weir landings which has been a traditional source of juveniles.

Tagging

From 1998 to 2002, the Pelagics Research Council/Herring Science Council, in partnership with Fisheries and Oceans Canada, tagged herring on spawning grounds and on the major Nova Scotia overwintering grounds (Waters et al 2001). A total of 92 647 herring were tagged. Although this project has concluded, tags continue to be returned with a total of 15 new returns. The information on tags returned from this study in 2003 has been summarized by Waters and Clark (2004).

Sampling and Catch at Age

Comprehensive biological sampling continued with substantial involvement of the fishing industry. A total of 1,605 samples comprising 182,000 fish were measured for length while 8,681 fish were sampled for age. The distribution of samples by gear and month is presented in Table 13. The sources of samples are shown in Table 14 with the bulk of samples coming from the processing industry, as has been the case since 1996. Additional samples were collected by: DFO personnel, observers deployed on purse seine vessels and from DFO research surveys. Sampling from the commercial fishery was well matched to the spatial and temporal distribution of the fishery. Additional sampling from research vessel surveys during the spring and summer resulted in widespread geographic coverage as in the past (Figure 20).

Consistent with previous assessments, the catch at age was constructed using the MFD 'Catch at Age' application (version 8.03) which is a Marine Fish Division windows based program for computing catch at age statistics as part of the stock assessment process. Data files used by 'Catch at Age' were created with the 'CATCHFRM' application that was used to select fish sample data from the Pelagic Samples Database. These data included a 2% adjustment for the shrinkage due to freezing on the length measurements for frozen samples (Hunt et al 1986). The length-weight relationships, which are also required as input to the 'Catch at Age' application, were calculated using an Oracle SQL*Plus script. The catch at age statistics were then calculated from length frequency and age-length key samples. The data were grouped or combined and then age-length keys were applied to length frequencies to produce catch at age statistics by NAFO unit area, gear-type and month.

Age Composition of the Catch

Under $F_{0.1}$ fishing and constant average recruitment, the age composition of the population caught in the fishery would be expected to be similar to that shown in Figure 21. There is peak abundance at age 4, substantial fish surviving older than

age 6 and a buildup of fish at ages 11+. This expected or ideal age structure has been used in recent assessments for comparison of the actual catch at age which has been characterized by a predominance of younger ages 2-3 and few fish older than six years old (Stephenson et al 1999b, 2001; Power et al 2002, 2003).

The 2000 year-class (at age 3) dominated the catch at age by weight (about 32% of the weight of herring landed), while the 2001 year-class (at age 2) dominated by number in the catch (46%) (Table 15, Figure 22). The 1998 year-class, which was dominant by weight in the catch in 2002 was approximately equal in representation to the following (1999) year-class in 2003. The pattern of dominance by age 2 and 3 fish was seen across all gear components including gillnet where age 3 fish are first recruited to that gear type (Table 15, Figure 23). The catch at age was also broken down by unit area and month for the purse seine sector which makes up the majority of the overall catch (Table 16-17, Figure 24-25). Once again age 2's and 3's predominated in all areas and months, including area 4Xr and 4Xq on the Nova Scotia side of the Bay of Fundy.

The historical series of catch at age was extended with the current fishing year and is shown as total number caught as well as percent by age (Table 18-19). The series shows very few fish older than age 7 in recent years and has been dominated by ages 2 through 4 since 1998 (Figure 26). The series is primarily made up of fish younger than age 6 but older ages were a feature when strong year-classes (i.e. 1976 and 1983) were progressing through the fishery (Figure 27).

Age composition in the fishery deteriorated in 2003, and remains a concern. There are few old fish (few age 7+; only 10% age 5+ by number) and the proportion of age 4+ in the catch has declined to about 20%. The rapid decline of year-classes (including the strong 1998 year-class) implies a high total mortality.

The proportion of age 4+, 5+ and 7+ were derived from the catch at age in numbers to determine trends in the older fraction of the catch (Figure 28). Age 7+ has shown a declining trend since about 1990 corresponding to the demise of the 1983 year-class, which was the last very strong year-class in this component. Age 5+ is more variable but has also exhibited a declining trend in recent years. Age 4+ has declined since 1996 except for 2002 with recruitment of the strong 1998 year-class.

Weight at Age

The average weights at age showed little change for all ages in the most recent years (Table 20 and Fig. 29), and were within the range of data observed historically (Power and Iles 2001). The most recent 5 year and 10 year average weights at age are consistently lighter than the overall series average (Figure 30) and reflect a general decline in weight at age that occurred for all ages in the mid 1980's.

2.3 Sources of Uncertainty

The evaluation of stock status in this area relies in large part on the spawning stock biomass estimates derived from industry acoustic surveys. There is considerable variability around individual acoustic survey estimates (standard errors are in the range of 10-60%) although studies of individual weir catches indicate that acoustic biomass estimates are within 15% of the amount of fish harvested. Uncertainty may also arise from assumptions concerning the residence time of herring on spawning grounds, target strength estimates and the coverage of surveys in relation to the extent of spawning.

An evaluation of progress against biological objectives in the management plan (DFO 2003b) indicate that some objectives are not being met (Table 21). In particular there are limited signs of recovery for the Trinity Ledge and Seal Island spawning components and there are few fish older than age 7 in the catch indicating high total mortality and the rapid decline of year classes. Also there is apparent high total mortality and targeting on 2 year olds. Some objectives are being met, in particular on spawning components like German Bank and Scots Bay, where the SSB is at moderate levels and recent landings have been less than 20% of survey SSB.

2.4 Ecosystem Considerations

Herring is prominent in the diet of many fish, birds and marine mammals, and should be managed with these interactions in mind. At present, use of a natural mortality rate of 0.2 and maintenance of SSB at moderate to high levels are assumed to account for these interactions.

Recent management initiatives to protect spawning components are intended to maintain the spatial and temporal diversity of herring spawning. Increased fishing on juveniles, which are of mixed or unknown stock affinity, is inconsistent with this objective.

2.5 Outlook

Recent assessments of the SWNS/BOF spawning component suggested that fishing mortality should remain below F0.1 (about 20% exploitation rate), for a number of years in order to rebuild spawning stock biomass in all spawning areas and to expand the age composition so as to meet the explicit biological objectives of management.

The 2003 fishery was 12,000t larger than in the previous year. Although acoustic surveys continue to show an SSB of approximately 500,000t, there has been a deterioration in the state of the stock and some of the conservation objectives specified for this fishery are not being met. There is an absence of older fish in the

population and increased targeting of juveniles. While there is spawning on Trinity Ledge and a small amount of spawning has been observed in recent years near Seal Island, the SSB on both Trinity Ledge and Seal Island spawning areas remain well below historical levels.

The rapid decline in year-classes (failure to reach older ages), even in the strong recent 1998 year-class, indicates high total mortality. It seems that the current catch is substantially higher than what would be consistent with a moderate F. Although these high exploitation rates have not resulted in a reduction of surveyed spawning biomass (presumably due to reasonable recruitment), the rebuilding that these recruits may have represented has been lost.

Recent catches have been consistent with the survey, assess, fish protocol of less than 20% of surveyed biomass. However the catch at age indicates that total mortality may be considerably higher. The increased trend to catch juveniles could compromise SSB, improvement in age composition and reoccupation of spawning grounds.

2.6 Management Considerations

The in-season management approach, which spreads the effort in the fishery spatially and temporally among spawning components, is seen as beneficial in achieving the conservation objectives. The "survey, assess, then fish" protocol is effective in spreading the catch appropriately among spawning components in proportion to their relative size and is considered an important safeguard.

Acoustic surveys have become critical to stock status evaluation. Surveys conducted in 2003 conformed to the proposed survey design. It is important that there be continued attention to coverage and survey design, in order to assure year-to-year consistency in these surveys in all spawning areas.

There has been insufficient progress towards conservation objectives in recent years (Table 21).

3) OFFSHORE SCOTIAN SHELF BANKS SPAWNING COMPONENT

3.1 The Fishery

A foreign fishery during 1963-1973 is estimated to have removed as much as 60,000t per year from the offshore Scotian Shelf banks. Few herring were caught after the extension of jurisdiction in 1977 until 1996, when a fishery was initiated by the 4WX purse seine fleet and 11,700t was taken (Table 3).

Since 1996 a fishery has taken place on feeding aggregations on the offshore banks primarily in May and June with catches ranging from 2,000 to 20,000t (Table 3). The variability in catch levels was often due to problems of fish being too deep, weather and market conditions rather than in the abundance of herring in these areas.

Landings from the 2003 fishery on the Scotian Shelf Banks (less than 1000t) were the smallest since the fishery was reactivated in 1996. Fishing by purse seine took place primarily in May and June, in the vicinity of The Patch and Western Hole (Table 1, Figure 31). In 2003, herring continued to be caught as by-catch in the domestic bottom trawl fishery on the Scotian Shelf edge and slope, but the amount was less than 70t (Table 1). There was midwater trawl activity on the offshore Scotian Shelf banks in May and November with a total of 52t landed.

The 1998 year-class (age 5) dominated the age composition of the Scotian Shelf fishery in both number and weight (Table 22, Figure 32).

3.2 Research and Industry Surveys

Industry Surveys

Fleet activity/catch in the spring/early summer fishery on the offshore banks of the Scotian Shelf continued to decrease in 2003. Acoustic recorders were activated on a few occasions but insufficient quantities of fish were observed to warrant analysis. Consequently, no acoustic biomass estimates were available from the Scotian Shelf (Melvin et al 2004).

July Bottom Trawl Survey

The summer bottom trawl survey showed few herring on the Scotian Shelf during the 1970's, increasing amounts during the 1980's and a relatively widespread distribution in recent years (Harris and Stephenson 1999, Power et al 2003, Stephenson et al 2001).

Offshore herring catches from this survey in 2003 were the second highest in the 34-year time series, with an average of over 170 fish per standard tow for strata 55 through 78 (Table 23, Figure 33). Survey catches of the past six years have been the highest on record (and in the 20 years in which the same vessel and gear have been used).

Trends are similar for the combined strata from each of the areas 4W and 4X (Table 23, Figure 34). The strata areas used for selection of trawling stations in this ground-trawl survey series are shown in Figure 35. Herring were again widely distributed on banks west of Sable Island (Figure 36) and were comparable to average catches from the last ten years (Figure 37). The overall size distribution for catches from all strata in 4WX shows that the bottom trawl is capable of catching a complete spectrum of herring from 5cm up to 40cm (Figure 38). There

are few fish larger than 35cm in recent years and there appears to be a modal progression for the past three years showing the possible tracking of a recent year class.

The survey data for areas 4WX combined were also analysed by age to produce stratified mean numbers per tow over the series (Table 24, Figure 39). There was a lack of consistency with the large year-classes observed in the fishery and a lack of tracking of these year-classes from year to year. There have been two major changes in the catch rates by bottom trawl over the series; the first is with to the introduction of the Alfred Needler in 1987 and a second large increase since 1994. The plot by age and year shows a lack of older ages in the catch over the past decade but does not appear to track strong year classes consistently (Figure 40).

Spring 4VsW Herring Survey

Since 1986 there has been a spring ground trawl research survey which had a primary goal of investigating NAFO area 4VsW cod. This survey has followed standard groundfish survey protocols using the same vessel (Alfred Needler), gear (Western IIa bottom trawl) and strata (Table 25, Figure 41). The herring catches from this survey have been highly variable from year to year with no consistent area patterns (Figure 42-43) or time trends (Figure 44). The recent increase since 1999 which was seen in the July trawl survey series is not evident in the spring 4VsW survey data. The overall length distribution for all strata combined shows a broad size range of herring captured including substantial numbers larger than 35 cm in 2003 (Figure 45).

Fall Herring Research Survey

There was no fall herring research survey on the Scotian Shelf due to a fire on the research vessel CCGS Alfred Needler.

3.3 Outlook and Management Considerations

The summer bottom trawl research survey demonstrates that there is a considerable abundance of herring widely spread over the offshore banks of the Scotian Shelf. Information from previous assessments indicated the presence of at least some autumn spawning on Western Bank in recent years. There is very little new information to add and no reason to change the previous outlook:

- Recorded landings in the foreign fisheries of 13,000t to 60,000t between 1969 and 1973 did not appear to be sustainable.

- The initial catch allocation for 2004 should not exceed the 12,000t reference value used in the recent fishing plans.

There continues to be insufficient documentation of stock size, distribution and spawning behaviour for this component. Industry, DFO Science and Management are encouraged to continue to work together to improve the biological basis for management. There continues to be the need for industry surveys to estimate abundance.

4) COASTAL (SOUTH SHORE, EASTERN SHORE AND CAPE BRETON) NOVA SCOTIA SPAWNING COMPONENT

4.1 The Fishery and Resource Status

In addition to traditional coastal fixed gear fisheries for subsistence and personal bait, there has been an increase in the number of active gillnet licenses in recent years aimed at spawning herring for the roe market (Clark et al 1999). This was the eighth year for a fishery on spawning fish off Halifax/Eastern Shore and the seventh year of gillnet roe fisheries off Little Hope/Port Mouton and Glace Bay.

Recorded landings (9,000t) in 2003 in the four major gillnet fisheries along the coast of Nova Scotia were higher for Little Hope/Port Mouton but lower in Eastern Shore/Halifax and Glace Bay (Bras d'Or Lakes remained closed) (Table 26).

Biomass estimates from surveys of the major coastal Nova Scotia spawning components were higher in 2003 with large increases in estimated SSB for the Little Hope, Eastern Shore and Glace Bay areas (Table 27) (Melvin et al 2004). There was no acoustic survey effort in the Bras d'Or lakes during 2003. Management of these spawning components using "survey, assess, then fish (<10%)" protocol is considered useful when the components are considered to be healthy and of sufficient size. The history of the application of this protocol has had some mixed success due to some occasional problems in executing surveys (Table 28).

History of Recent Catch and Effort

The history of the recent catch and effort by gillnet on the three main spawning components along coast Nova Scotia is documented in Table 29-31. Rather than showing the number of licenses, many of which are inactive, the landings data was used to report days fished, number of active boats, catch per day and catch per boat. The number of nets fished or soak time was not readily available but these have not changed substantially by spawning ground over the recent period.

Little Hope

The fishery occurred in the Port Mouton/Little Hope area in September and October with a total of 4,500t of herring landed (Figure 46). Daily length samples

were taken from October 1-9 with most fish larger than 25cm (Figure 47). Only one sample of spawning fish was available from Oct. 1 with 93% in spawning condition (Figure 48). Sampling indicated that the catch was composed primarily of 1996-1998 year-classes (ages 5-7) (Table 32, Figure 49). Both catch and effort as measured by the number of active boats have been increasing in this area since 1997 (Figure 50, Table 29). The CPUE as measured by catch/boat for the spawning season has been relatively stable since the year 2000.

A total of four surveys took place on the spawning ground of which only the final one had a boat with a sounder recording system. An acoustic estimate of 62,500t (56% SE) SSB based on one mapping and one acoustic survey was the highest for this area to date (Table 27) (Melvin et al 2004).

East of Halifax (4W Eastern Shore)

The roe fishery for the Eastern Shore area in September and October landed 2,700t (Figure 51). Sampling was limited to the two survey nights and indicated that the catch was composed of spawning fish mainly of the 1996 - 1998 year-classes (age 5-7) (Figure 52-54, Table 32). Total catch and effort have increased in the most recent two years over the earlier period since 1996 (Table 30, Figure 55). The CPUE measures, however, for catch/slip and catch per boat have remained relatively stable.

Acoustic surveys undertaken by the Eastern Shore Fishermen's Protective Association in September and October 2003 estimated an SSB of 76,500t (19% SE), the highest for the area to date (Table 27) (Melvin et al 2004).

Glace Bay

The fishery off Glace Bay, Cape Breton took place in September and October with total landings of 1,900t, which was a large decrease from the previous year (Table 26, Figure 56). The reduction in catch was attributed to timing problems associated with closing and opening of the fishery as well as weather affecting behaviour of the herring schools. Length samples indicated large herring, mostly over 30 cm in total length (Figure 57), while maturity samples taken in September were primarily of spawning fish (Figure 58). Fish aged 7 (1996 year-class) dominated the catch (Figure 59, Table 32).

Approximately 31,500t of spawning herring was estimated from three mapping surveys off Glace Bay in the month of September.

Total catch and effort as measured by the number of boats and days fished has been higher in recent years for this area (Table 31, Figure 60). There was a decrease in CPUE in 2003 due to timing of the fishery opening and weather related effects on fish behavior.

In the July groundfish survey, stratum 42 (Figure 35) covers the area of 4Vn that includes the fall roe fishery off Glace Bay. In 2001, survey catches by number and weight from this stratum were the highest in the past twelve years (Table 33). In 2002 and 2003, however, overall catches of herring in this stratum were reduced dramatically. There is a great deal of annual variability in the numbers and weights of herring caught by this survey and it does not appear to be representative of herring abundance as seen in the fall spawning areas.

Bras d'Or Lakes

The fishery was closed. The Eskasoni Fish & Wildlife Commission Inc. continued to gather scientific samples of the Bras d'Or Lakes herring in the absence of a commercial fishery again in 2003 (Figure 61-63). In addition, herring spawning locations were recorded and spawning beds measured. The samples showed a broad age distribution, dominated by age 7 (1996 year-class) (Figure 64).

Sampling and spawning in 2003 occurred later in the year compared to previous years due to the presence of ice on the Bras d'Or Lakes that had covered approximately 80% or more of the Bras d'Or Lake. Herring samples were obtained using multi-mesh sized nylon nets each 150 ft in length constructed of differing sizes of mesh (1 5/16, 1 ½, 1 ¾, 2 ½, and 2 ¾) to capture herring. A metal egg grabber was also used on spawning beds to first determine egg presence. When eggs were discovered, scuba or snorkeling was used to measure the spawning bed. Great care was taken to prevent damage or reduce egg presence on spawning beds.

The spring spawning herring component were sampled weekly between April 24th and June 3, 2003 in East Bay, Big Harbour Island, Soldier's Cove, Iona, Grand Narrows, West Bay and Baddeck Bay. Confirmation of spring spawning occurred at Black Rock, Baddeck Bay (3 sites), Lighthouse Point, MacKinnon's Habour and Marble Mountain. No evidence of spawning could be found between Johnstown to St. Peter's, West Bay or around the Barra Strait (either direction). The River Denys Basin was not checked.

Sampling continued weekly after the spring run to determine if herring were still present in the Bras d'Or Lakes. Herring in spawning condition (maturity 5 and 6) were found in East Bay on Sept. 17 and herring were still captured in small quantities in the Bras d'Or Lakes until Nov. 28, 2003 after which sampling ceased due to weather. However, evidence of fall spawning was not found and it is suspected that spawning occurred at depths greater than 30 ft. Visibility tends to be poor under water at this time in the Bras d'Or Lakes and the egg grab contraption was difficult to drag at deeper depths.

In 2003 no acoustic surveys were conducted in the Bras d'Or lakes to document the abundance of spawning herring.

4.2 Outlook and Management Considerations

There is no overall quota for the coastal Nova Scotia spawning component and apart from the areas mentioned above; the size and historical performance of various spawning groups are poorly documented. In addition to traditional fisheries for bait and personal use, there are new directed roe fisheries on the spawning grounds.

As the inshore roe fisheries off Glace Bay, East of Halifax and Little Hope have developed, participants have contributed to sampling and surveying and the fisheries have attempted to follow the 'survey, assess, fish' protocol. Surveys and sampling in these areas improved over previous years and should be continued.

Management approaches and recent research efforts have improved knowledge in these three areas, but there has been no increase in knowledge in adjacent areas. Individual spawning groups within this component are considered vulnerable to fishing because of their relatively small size and proximity to shore. As in the past five years, it is recommended that no coastal spawning areas should experience a large effort increase until much more information is available on the state of that spawning group, and there should be no new fisheries developed when there is uncertainty regarding stock composition and degree of mixing.

It has been noted since 1997 that the status of herring in the Bras d'Or Lakes is cause for concern. Spawning is still absent from some traditional areas and the observed biomass of spring spawners is very low. It is therefore appropriate to reiterate that from a biological perspective, that no fishing take place on this spawning component.

5) SW NEW BRUNSWICK MIGRANT JUVENILES

The southwest New Brunswick weir and shutoff fisheries have relied for over a century, on the aggregation of large numbers of juvenile herring (ages 1-3) near shore at the mouth of the Bay of Fundy. These fish have been considered to be a mixture of juveniles, dominated by those originating from NAFO Subarea 5 spawning components, and have therefore been excluded from the 4WX quota.

Mature herring (ages 4+) taken in this fishery are considered to be of 4WX origin. The 2003 catch was dominated by the 2001 year-class (age 2), which made over 80% of the catch by number and 70% of the catch by weight (Table 34, Figure 65-66).

The recent US management plans (NEFSC 1998, 2004) assumes that all of the juvenile herring from this fishery originate from the US "coastal complex" (5Y + 5Z) which is reported to be at record high levels of abundance.

The number and distribution of active weirs have decreased over the past decade, due in part to the conversion of sites to aquaculture, as well as the reduction in landings over the past decade in the Passamaquoddy Bay area (Table 3, 7). There was a further drop in landings in the traditional New Brunswick weir and shutoff fishery to 9,000t - the lowest since 1983 – and there is concern for this fishery (Table 1-2, Figure 67).

In 2002 the Fundy Weir Fishermen Association, Inc., in partnership with the New Brunswick Department of Agriculture, Fisheries and Aquaculture, the Grand Manan Fishermen's Association, Connors Brothers Ltd. and Fisheries and Oceans, Canada, initiated a tagging program, to be conducted over a three year period. The purpose of this project is to investigate the seasonal movements and migration of herring in the Bay of Fundy with the long-term goal of providing information on stock structure. Since the start of this project a total of 46,330 herring have been tagged and 1,379 tags have been recovered. The results to date are summarized by Waters and Clark (2004).

6) 5Z Georges Bank

The activities of a single midwater trawler on the Canadian portion of Georges Bank (area 5Z) have also been summarized (Table 1). There were a total of 1,750t landed from July to Oct. with most of the landings in September (Figure 68). These catches were dominated by the 1998 year-class at age 5 in numbers and weight (Table 35, Figure 69).

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Table 1. 4VWX herring fishery landings (t) by month, gear sector and management unit for 2002-2003 quota year.

			Month												
	Area	Gear	1	2	3	4	5	6	7	8	9	10	11	12	Total
S.W. Nova Scotia	4W	Fall/Winter P. Seine										-	-	-	-
	4X	Fall P. Seine (2002)										3,752	2,596	129	6,477
		Winter P. Seine (2003)	1,890	493											2,383
		P. Seine (2003)					4,229	3,727	19,637	20,321	21,073	10,153			79,140
		Gillnet "Stock"						69		53	316				439
		N.S. Weirs					98	126	68	344	284				921
S.W. Nova Scotia Total			1,890			-	4,327	3,923	19,705	20,718	21,673	13,905	2,596	129	89,360
Coastal Nova Scotia (South Shore, Eastern Shore, Cape Breton)	4Vn	Trap				-	-	-							-
		Misc. Gillnet				0	2	2							4
		Glace Bay Gillnet									1,905				1,905
	4W	Eastern Shore Gillnet									1,227	1,500			2,727
	4X	Little Hope Gillnet						0		0	776	3,750			4,526
Coastal Nova Scotia Total				-		0	2	2	-	0	3,908	5,250	-		9,162
Offshore S.S.	4WX	Offshore P. Seine					55	823							878
		Midwater Trawl					36						16		52
		Bottom Trawl + Misc.	4	1	3	5	15	16	0	0	2	7	12	2	68
Offshore S.S. Total			4	1	3	5	106	839	0	0	2	7	28	2	998
Migrant Juveniles	4X	N.B. Weirs					257	250	1,423	3,554	3,166	344	10		9,003
		N.B. Shutoff *					-	1	-	-	1	1	1		4
Migrant Juveniles Total							257	251	1,423	3,554	3,167	345			9,007
Georges Bank	5ZE	5Z Purse Seine							-	-	-	-			-
		Midwater Trawl							28	180	942	599			1,749
Georges Bank Total									28	180	942	599			1,749

* MARFIS gear conversion and data entry problem

Total 2002-03	110,275

Table 2. 4WX herring fishery landings (t) by month, gear sector for 2003-2004 quota year (current as of Mar. 1, 2004).

			Month												
	Area	Gear	1	2	3	4	5	6	7	8	9	10	11	12	Total
2003-04 quota year	4X	Fall 2003 P. Seine										2,554	1,555	57	4,166
		Winter 2004 P. Seine	1,263	182											1,445
	4WX	Bottom Trawl	1	2											3
2003-04 Total (to date)			1,264	184	-	-	-	-	-	-	-	2,554	1,555	57	5,614

Table 3. Historical series of nominal and adjusted annual landings (t) by major gear components and seasons of the 4WX herring fishery, 1963-2003 (the 1963-73 Offshore Scotian Shelf landings are from Stephenson et al. (1987)).

Year^	4W Winter Purse Seine	4Xs Fall&Winter Purse Seine	4Xqr Summer Purse Seine	4X Summer Gillnet	4Xr Summer Weir	4WX Stock Nominal Landings	4WX Stock Adjusted Landings*	4WX Stock TAC	Non-Stock 4Xs Weir and Shutoff	Offshore Scotian Shelf Banks	Total 4WX Adjusted Landings
1963		6,871	15,093	2,955	5,345	30,264	30,264		29,366	3,000	62,630
1964		15991	24,894	4,053	12,458	57,396	57,396		29,432	2,000	88,828
1965		15,755	54,527	4,091	12,021	86,394	86,394		33,346	6,000	125,740
1966		25,645	112,457	4,413	7,711	150,226	150,226		35,805	2,000	188,031
1967		20,888	117,382	5,398	12,475	156,143	156,741		30,032	1,000	187,773
1968		42,223	133,267	5,884	12,571	193,945	196,362		33,145	18,000	247,507
1969	25,112	13,202	84,525	3,474	10,744	137,057	150,462		26,539	121,000	298,001
1970	27,107	14,749	74,849	5,019	11,706	133,430	190,382		15,840	87,000	293,222
1971	52,535	4,868	35,071	4,607	8,081	105,162	129,101		12,660	28,000	169,761
1972	25,656	32,174	61,158	3,789	6,766	129,543	153,449		32,699	21,000	207,148
1973	8,348	27,322	36,618	5,205	12,492	89,985	122,687		19,935	14,000	156,622
1974	27,044	10,563	76,859	4,285	6,436	125,187	149,670		20,602		170,272
1975	27,030	1,152	79,605	4,995	7,404	120,186	143,897		30,819		174,716
1976	37,196	746	58,395	8,322	5,959	110,618	115,178		29,206		144,384
1977	23,251	1,236	68,538	18,523	5,213	116,761	117,171	109,000	23,487		140,658
1978	17,274	6,519	57,973	6,059	8,057	95,882	114,000	110,000	38,842		152,842
1979	14,073	3,839	25,265	4,363	9,307	56,847	77,500	99,000	37,828		115,328
1980	8,958	1,443	44,986	19,804	2,383	77,574	107,000	65,000	13,525		120,525
1981	18,588	1,368	53,799	11,985	1,966	87,706	137,000	100,000	19,080		156,080
1982	12,275	103	64,344	6,799	1,212	84,733	105,800	80,200	25,963		131,763
1983	8,226	2,157	63,379	8,762	918	83,442	117,400	82,000	11,383		128,783
1984	6,336	5,683	58,354	4,490	2,684	77,547	135,900	80,000	8,698		144,598
1985	8,751	5,419	87,167	5,584	4,062	110,983	165,000	125,000	27,863		192,863
1986	8,414	3,365	56,139	3,533	1,958	73,409	100,000	97,600	27,883		127,883
1987	8,780	5,139	77,706	2,289	6,786	100,700	147,100	126,500	27,320		174,420
1988	8,503	7,876	98,371	695	7,518	124,653	199,600	151,200	33,421		233,021
1989	6,169	5,896	68,089	95	3,308	83,557	97,500	151,200	44,112		141,612
1990	8,316	10,705	77,545	243	4,049	102,627	172,900	151,200	38,778		211,678
1991	17,878	2,024	73,619	538	1,498	97,010	130,800	151,200	24,576		155,376
1992	14,310	1,298	80,807	395	2,227	100,227	136,000	125,000	31,967		167,967
1993	10,731	2,376	81,478	556	2,662	98,464	105,089	151,200	31,573		136,662
1994	9,872	3,174	64,509	339	2,045	80,099	80,099	151,200	22,241		102,340
1995	3,191	7,235	48,481	302	3,049	62,499	62,499	80,000	18,248		80,747
1996	2,049	3,305	42,708	6,340	3,476	58,068	58,068	57,000	15,913	11,745	85,726
1997	1,759	2,926	40,357	6,816	4,019	56,117	56,117	57,000	20,552	20,261	96,930
1998	1,405	1,494	67,433	2,231	4,464	77,027	77,027	90,000	20,091	5,591	102,709
1999	1,235	4,764	64,432	1,660	5,461	77,552	77,552	105,000	18,644	12,646	108,842
2000	1,012	4,738	78,010	823	701	85,284	85,284	100,000	16,829	2,182	104,295
2001	0	4,001	62,004	1,857	3,708	71,570	71,570	78,000	20,209	12,503	104,282
2002	367	5,257	69,894	393	1,143	77,054	77,054	78,000	11,874	7,039	95,967
2003	0	8,860	79,140	439	921	89,360	89,360	93,000	9,003	998	99,361
2004		5,613				5,613	5,613	TBA			5,613

^Annual landings by purse seiners are defined for the period from October 15 of the preceding year to October 14 of the current year.

*Adjusted totals includes misreporting adjustments for 1978-84 (Mace 1985) and for 1985-93 (Stephenson 1993, Stephenson et al 1994)

All landings by other gear types are for the calendar year.

Table 4. Summary of herring purse seine catches (t) from 1984 to 2003 by year and fishing grounds.

Stock Areas	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Avg 91-02
Browns Bank			732						86		1903	1554	40	14	3139	2197	1137	486			1173
Chedabucto Bay	490	4216	7498	6374	7523	8325	12470	12596	3084	1378	1407	2049	1759		1583	1151	10				2780
Gannet,Dry Ledge		5675	2187	1474	14901	2010	4213	6294	18527	2935	2588	2693	1963	4590	4156	10296	12674	3877	9047	6965	6637
German Bank		15522	13346	16547	18392	8087	11744	23193	3235	4045	9662	19549	15898	13576	20556	24660	25631	24139	22355	21573	17208
Grand Manan	372	4989	5823	4298	4440	4300	5442	4225	2722	783	6846	5297	6005	5312	15983	7912	18185	10545	17753	17258	8464
Long Island		974	3365	7499	10722	21719	18484	9470	3213	2814	7666	7906	4385	3557	12360	18286	11199	12904	6642	12639	8367
Lurcher		476	132		2928	18	65	151	2141	1560	530	382	243	599	57		715	227	7683	1872	1299
N.B. Coastal	384	188	621	960	1031	3033	2347	488	992	598	99	1502	271	1176	782	1867	361	1250	3113	3914	1042
Pollock Point																		1563			1563
S.W. Grounds		558	1108	184	181	276	56	521	225	2961	3444	6205	3035	797	1239	3241	1879	53	791	73	2032
Scots Bay			36	3822	4145	6583	9003	7982	7987	5258	10840	980	8984	4894	8210	1789	10926	10739	8202	19196	7233
Seal Island		13818	8894	11560	19019	23420	25344	12740	10455	3874	2820	465	1567	492	617	567	206	101	238	1096	2845
Trinity		35860	13505	18744	18539	266	1113	3259	4612	1348	2366	370	3448	5308	2825	1220	103	113	1609		2215
Yankee Bank					194	250	3647	817	119	10	175	323	9	4	159	82	133	8	78		160
Unknown	45	184	500	200			200	579	494	140		73			62	84	27			1103	208
4WX Stock Total	1291	82458	57745	71661	102015	78287	94127	82314	57888	27703	50345	49348	47606	40319	71727	73350	83186	66005	77511	85689	60608

Nonstock Areas	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Avg 91-02
Georges Bank							91	64			266		2491	79			265				633
Liverpool								13		4067	4177										2752
Shelburne				59				64		526	161		56								202
Halifax										652	1945		585	455			1002	472	367		783
Offshore Banks													11800	18770	4284	8669	1645	3977	5078	722	7746
Western Hole			41	154				213	3451	2255	1495	108	127	691	1012	1057	47	7712	1884	156	1671
Sydney Bight		3511	4250	1751	2100	1330	3591	3606		396		3951	4267		52						2454
Nonstock Total		3511	4291	1964	2100	1330	3682	3959	3451	7896	8044	4059	19325	19995	5348	9726	2958	12161	7329	878	8688

Overall Total	1291	85968	62036	73625	104116	79617	97809	86273	61339	35598	58389	53407	66931	60314	77075	83076	86144	78166	84840	86567	69296

Table 5. Summary of the percentage of herring purse seine catches from 1984 to 2003 by year and fishing grounds.

Stock Areas	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Avg 91-02
Browns Bank			1%						0%		3%	3%	0%	0%	4%	3%	1%	1%			1%
Chedabucto Bay	38%	5%	12%	9%	7%	10%	13%	15%	5%	4%	2%	4%	3%		2%	1%	0%				3%
Gannet,Dry Ledge		7%	4%	2%	14%	3%	4%	7%	30%	8%	4%	5%	3%	8%	5%	12%	15%	5%	11%	8%	9%
German Bank		18%	22%	22%	18%	10%	12%	27%	5%	11%	17%	37%	24%	23%	27%	30%	30%	31%	26%	25%	24%
Grand Manan	29%	6%	9%	6%	4%	5%	6%	5%	4%	2%	12%	10%	9%	9%	21%	10%	21%	13%	21%	20%	11%
Long Island		1%	5%	10%	10%	27%	19%	11%	5%	8%	13%	15%	7%	6%	16%	22%	13%	17%	8%	15%	12%
Lurcher		1%	0%		3%	0%	0%	0%	3%	4%	1%	1%	0%	1%	0%		1%	0%	9%	2%	2%
N.B. Coastal	30%	0%	1%	1%	1%	4%	2%	1%	2%	2%	0%	3%	0%	2%	1%	2%	0%	2%	4%	5%	2%
Pollock Point																		2%			0%
S.W. Grounds		1%	2%	0%	0%	0%	0%	1%	0%	8%	6%	12%	5%	1%	2%	4%	2%	0%	1%	0%	3%
Scots Bay			0%	5%	4%	8%	9%	9%	13%	15%	19%	2%	13%	8%	11%	2%	13%	14%	10%	22%	11%
Seal Island		16%	14%	16%	18%	29%	26%	15%	17%	11%	5%	1%	2%	1%	1%	1%	0%	0%	0%	1%	4%
Trinity		42%	22%	25%	18%	0%	1%	4%	8%	4%	4%	1%	5%	9%	4%	1%	0%	0%	2%		3%
Yankee Bank					0%	0%	4%	1%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%		0%
Unknown	4%	0%	1%	0%			0%	1%	1%	0%		0%			0%	0%	0%			1%	0%
Total	100%	96%	93%	97%	98%	98%	96%	95%	94%	78%	86%	92%	71%	67%	93%	88%	97%	84%	91%	99%	86%

Stock Areas	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Avg 91-02
Georges Bank							0%	0%			0%		4%	0%			0%				0%
Liverpool								0%		11%	7%										2%
Shelburne				0%				0%		1%	0%		0%								0%
Halifax										2%	3%		1%	1%			1%	1%	0%		1%
Offshore Banks													18%	31%	6%	10%	2%	5%	6%	1%	6%
Western Hole			0%	0%				0%	6%	6%	3%	0%	0%	1%	1%	1%	0%	10%	2%	0%	3%
Sydney Bight		4%	7%	2%	2%	2%	4%	4%		1%		7%	6%		0%						2%
Misc Nonstock Total		4%	7%	3%	2%	2%	4%	5%	6%	22%	14%	8%	29%	33%	7%	12%	3%	16%	9%	1%	14%

Table 6. Monthly weir landings (t) for weirs located in New Brunswick and Nova Scotia; 1978 to 2003.

		MONTH												
PROVINCE	YEAR	1	2	3	4	5	6	7	8	9	10	11	12	Year Total
N.B.	1978	3				512	802	5,499	10,275	10,877	4,972	528	132	33,599
	1979	535	96			25	1,120	7,321	9,846	4,939	5,985	2,638	74	32,579
	1980					36	119	1,755	5,572	2,352	1,016	216		11,066
	1981					70	199	4,431	3,911	2,044	2,435	1,686	192	14,968
	1982		17			132	30	2,871	7,311	7,681	3,204	849	87	22,181
	1983					65	29	299	2,474	5,382	3,945	375		12,568
	1984					6	3	230	2,344	2,581	3,045	145		8,353
	1985					22	89	4,217	8,450	6,910	4,814	2,078	138	26,718
	1986	43				17		2,480	10,114	5,997	6,233	2,564	67	27,516
	1987	39	21	6	12	10	168	2,575	10,893	6,711	5,362	703	122	26,621
	1988		12	1	90	657	287	5,993	11,975	8,375	8,457	2,343	43	38,235
	1989		24		95	37	385	8,315	15,093	10,156	7,258	2,158		43,520
	1990					93	20	4,915	14,664	12,207	7,741	168		39,808
	1991					57	180	4,649	10,319	6,392	2,028	93		23,717
	1992				15	50	774	5,477	10,989	9,597	4,395	684		31,981
	1993					14	168	5,561	14,085	8,614	2,406	470	10	31,328
	1994				18		55	4,529	10,592	3,805	1,589	30		20,618
	1995					15	244	4,517	8,590	3,956	896	10		18,228
	1996					19	676	4,819	7,767	1,917	518	65		15,781
	1997				8	153	1,017	6,506	7,396	5,316				20,396
	1998					560	713	3,832	8,295	5,604	525			19,529
	1999					690	805	5,155	9,895	2,469	48			19,063
	2000					10	7	2,105	7,533	4,940	1,713	69		16,376
	2001					35	478	3,931	8,627	5,514	1,479			20,064
	2002					84	20	1,099	6,446	2,878	1,260	20		11,807
	2003					257	250	1,423	3,554	3,166	344	10		9,003
NB Average Catch (t)		155	34	3	40	145	345	4,019	8,731	5,784	3,267	814	96	22,909
N.S.	1978				1	490	3,704	2,990	239	46	111	198	79	7,858
	1979					811	3,453	1,418	420	39	136	57		6,339
	1980					69	647	1,271	395					2,383
	1981					50	437	983	276	37		41		1,824
	1982					16	267	468	195	172	12			1,130
	1983				2	286	141	188	208	53		18		896
	1984					113	1,032	736	602	220				2,702
	1985					378	1,799	1,378	489			11		4,055
	1986					385	403	71	704	390	5			1,957
	1987					1,503	2,526	1,215	1,166	367				6,776
	1988					1,217	2,976	1,696	1,204	386				7,480
	1989					340	1,018	870	843	226				3,296
	1990					208	973	1,482	879	538	52			4,132
	1991				3	23	149	719	342	262				1,498
	1992					35	659	405	754	371				2,224
	1993					226	908	608	867	53				2,662
	1994					111	736	499	519	180				2,045
	1995					236	1,255	1,059	470	29				3,049
	1996					430	1,267	1,232	358	188				3,476
	1997					70	1,874	1,739	271	65				4,019
	1998					1,304	1,677	390	359	317				4,048
	1999					1,958	1,513	547	488	31				4,537
	2000						16	151	326	191				683
	2001					105	1,439	1,565	391	207				3,708
	2002					23	95	240	558	228				1,143
	2003					98	126	68	344	284				921
NS Average Catch (t)					2	419	1,196	923	526	203	63	65	79	3,263

Table 7. Overall effort from New Brunswick and Nova Scotia weirs for catch (t), number of active weirs and the catch per weir for the period 1978 to 2003.

	Catch t			No. Active Weirs			Catch per weir		
Year	NB	NS	Total Catch	NB	NS	Total No.	NB	NS	Average
1978	33,599	7,858	41,458	208	31	239	162	253	173
1979	32,579	6,339	38,918	210	27	237	155	235	164
1980	11,066	2,383	13,449	120	29	149	92	82	90
1981	14,968	1,824	16,793	147	28	175	102	65	96
1982	22,181	1,130	23,311	159	19	178	140	59	131
1983	12,568	896	13,464	143	23	166	88	39	81
1984	8,353	2,702	11,056	116	13	129	72	208	86
1985	26,718	4,055	30,774	156	14	170	171	290	181
1986	27,516	1,957	29,473	105	18	123	262	109	240
1987	26,621	6,776	33,397	123	21	144	216	323	232
1988	38,235	7,480	45,715	191	21	212	200	356	216
1989	43,520	3,296	46,817	171	20	191	255	165	245
1990	39,808	4,132	43,940	154	22	176	258	188	250
1991	23,717	1,498	25,216	143	20	163	166	75	155
1992	31,981	2,224	34,206	151	12	163	212	185	210
1993	31,328	2,662	33,990	145	10	155	216	266	219
1994	20,618	2,045	22,662	129	11	140	160	186	162
1995	18,228	3,049	21,277	106	10	116	172	305	183
1996	15,781	3,476	19,257	101	12	113	156	290	170
1997	20,396	4,019	24,415	102	15	117	200	268	209
1998	19,529	4,048	23,577	108	15	123	181	270	192
1999	19,063	4,537	23,600	100	14	114	191	324	207
2000	16,376	683	17,058	77	3	80	213	228	213
2001	20,064	3,708	23,772	101	14	115	199	265	207
2002	11,807	1,143	12,950	83	9	92	142	127	141
2003	9,003	921	9,924	78	8	86	115	115	115
Average	22,909	3,263	26,172	132	17	149	173	203	176

Table 8. Gillnet effort for the Spectacle Buoy area from landings in the month of June for statistical districts 31,32,33,34 and 36 (Barrington to St. Mary's Bay, N.S.).

Year	No. Days Fished	No. of Boats Fishing	Total Catch t	CPUE Catch/Day	CPUE Catch/Boat
1997	815	84	2,699	3.3	32.1
1998	175	27	468	2.7	17.3
1999	81	10	239	3.0	23.9
2000	38	8	80	2.1	10.0
2001	136	13	442	3.3	34.0
2002	43	15	113	2.6	7.5
2003	11	6	69	6.3	11.6

Table 9. Gillnet effort for the Trinity Ledge area from landings in the months of August and Sept. for statistical districts 31,32,33,34 and 36 (Barrington to St. Mary's Bay, N.S.).

Year	No. Days Fished	No. of Boats Fishing	Total Catch t	CPUE Catch/Day	CPUE Catch/Boat
1996	613	102	6,138	10.0	60.2
1997	1031	71	3,448	3.3	48.6
1998	418	19	1,668	4.0	87.8
1999	332	32	1,286	3.9	40.2
2000	186	28	740	4.0	26.4
2001	357	31	1,012	2.8	32.7
2002	98	19	256	2.6	13.5
2003	83	22	369	4.5	16.8

Table 10. Purse seine effort, catch and CPUE levels for 1989 to 2003.

Year	No. Days Fished	No. of Boats Fishing	Total Catch t	CPUE (catch/slip)	CPUE (catch/boat)
1989	2198	40	87,383	40	2185
1990	2390	42	103,537	43	2465
1991	2333	40	88,830	38	2221
1992	2431	39	95,072	39	2438
1993	2542	36	92,828	37	2579
1994	2227	36	75,652	34	2101
1995	1682	32	56,441	34	1764
1996	1781	32	60,038	34	1876
1997	1731	30	61,769	36	2059
1998	2290	28	70,931	31	2533
1999	1775	28	78,574	44	2806
2000	1572	28	78,727	50	2812
2001	1826	21	75,343	41	3588
2002	1838	19	76,210	41	4011
2003	1652	18	85,499	52	4750

Table 11. Summary of the minimum observed spawning stock biomass for each of the surveyed spawning grounds in the Bay of Fundy/SW Nova component of the 4WX stock complex (Melvin et al 2004).

Location/Year	1997	1998	1999	2000	2001	2002	2003
Scots Bay	160,200	72,500	41,000	106,300	163,900	141,000	133,900
Trinity Ledge	23,000	6,800	3,900	600	14,800	8,100	14,500
German Bank	370,400	440,700	460,800	356,400	190,500	393,100	343,400
Spectacle B							
- Spring	15,000	1,300	0	0	1,100		1,400
- Fall					87,500		
Sub-Total	568,600	521,300	505,700	463,300	457,800	542,200	493,200
Seal Island					3,300	1,200	12,200
Browns Bank					45,800		
Total					506,900	543,400	505,400

Table 12. Partial exploitation rates (%) by major spawning grounds and for the overall Bay of Fundy/SW Nova component of the 4WX stock complex with a) acoustic survey SSB (data for Seal Island and Spectacle Buoy included as German Bank) b) allocated catch by spawning component c) exploitation rate as percentage of acoustic SSB and d) exploitation rate calculated as an instantaneous fishing mortality rate (F).

A) Acoustic Survey SSB	1997	1998	1999	2000	2001	2002	2003
Scots Bay	160,200	72,500	41,000	106,300	163,900	141,000	133,900
Trinity	23,000	6,800	3,900	600	14,800	8,100	14,500
German Bank	385,400	442,000	460,800	356,400	282,400	394,300	357,100
Total SSB (t)	568,200	521,300	505,700	463,300	461,100	543,400	505,500

B) Allocated Catches	1997	1998	1999	2000	2001	2002	2003
Scots Bay	12,426	15,141	5,722	21,955	23,225	19,786	32,247
Trinity	11,628	2,442	2,922	807	2,413	2,511	1,725
German Bank	32,079	59,445	68,908	62,522	45,932	54,757	55,388
Total Catch (t)	56,133	77,027	77,552	85,284	71,570	77,054	89,360

C) Exploitation Rate (%)	1997	1998	1999	2000	2001	2002	2003
Scots Bay	8%	21%	14%	21%	14%	14%	24%
Trinity	51%	36%	75%	135%	16%	31%	12%
German Bank	8%	13%	15%	18%	16%	14%	16%
Overall Exploitation (%)	10%	15%	15%	18%	16%	14%	18%

D) Exploitation Rate (F)	1997	1998	1999	2000	2001	2002	2003
Scots Bay	0.08	0.23	0.15	0.23	0.15	0.15	0.28
Trinity	0.70	0.44	1.38	n/a	0.18	0.37	0.13
German Bank	0.09	0.14	0.16	0.19	0.18	0.15	0.17
Overall Exploitation (F)	0.10	0.16	0.17	0.20	0.17	0.15	0.19

Table 13. Summary of biological samples by gear and month as collected during the 2003 4VWX herring fisheries. 'No. Samples' is the number of length frequency samples collected, 'No. Measured' is the number of length frequency fish measured and 'No. Aged' is the number of detail fish with age determined.

		Month												
Gearname	Data	1	2	3	4	5	6	7	8	9	10	11	12	Total
4W Purse Seine	No. Samples						13							13
	No. Measured						1666							1666
	No. Aged						0							0
5Y CAN P.Seine	No. Samples					2	15		40	2	3	4		66
	No. Measured					355	1805		4599	116	446	506		7827
	No. Aged					0	21		179	42	0	19		261
5Y USA P.Seine/MWT	No. Samples	1				2	19	9	2	7	2	27		69
	No. Measured	105				240	2293	1047	230	794	237	3245		8191
	No. Aged	0				0	0	0	0	0	0	0		0
5Z CAN MW Trawl	No. Samples								5	3	4			12
	No. Measured								1077	317	650			2044
	No. Aged								14	0	32			46
5Z USA P.Seine/MWT	No. Samples	14	5	1	1			1				1	2	25
	No. Measured	1471	543	122	135			122				124	243	2760
	No. Aged	0	0	0	0			0				0	0	0
Gillnet	No. Samples				1	16	2	1	2	6	9			37
	No. Measured				34	732	36	1	637	899	1140			3479
	No. Aged				28	207	34	1	33	196	111			610
Midwater Trawl	No. Samples					1								1
	No. Measured					195								195
	No. Aged					0								0
N.B. Purse Seine	No. Samples	55	21	1		4	16	30	1	44	64	4		240
	No. Measured	5820	2202	100		473	2134	3660	105	5473	8614	507		29088
	No. Aged	113	152	0		0	85	53	0	118	173	17		711
N.B. Shut-off	No. Samples						1			9	1	1		12
	No. Measured						253			1086	103	121		1563
	No. Aged						27			19	0	26		72
N.B. Weirs	No. Samples					10	17	58	138	133	43	2		401
	No. Measured					1127	2078	7057	16992	15606	5154	247		48261
	No. Aged					20	152	360	701	506	289	17		2045
N.S. Purse Seine	No. Samples					47	40	155	138	114	19	10		523
	No. Measured					6302	4996	21676	20454	15789	2687	1158		73062
	No. Aged					31	120	472	1021	656	76	38		2414
N.S. Weirs	No. Samples					3	3	4	5	9				24
	No. Measured					473	351	512	603	1187				3126
	No. Aged					23	11	62	56	159				311
Resrch. Otter Trawl	No. Samples		31	43				105						179
	No. Measured		171	283										454
	No. Aged		247	740				1224						2211
USA Shut-off	No. Samples						3							3
	No. Measured						391							391
	No. Aged						0							0
Total Number of Samples		70	57	45	2	85	129	363	331	327	145	49	2	1605
Total Number Measured		7396	2916	505	169	9897	16003	34075	44697	41267	19031	5908	243	182107
Total Number Aged		113	399	740	28	281	450	2172	2004	1696	681	117	0	8681

Table 14. Number of herring samples collected by DFO personnel from commercial fisheries (Commercial), by members of the fishing industry (Industry), observer program (Observer), independent observers on foreign vessels (OSS) and DFO research surveys (Research).

	Sample Source					
Year	Commercial	Industry	Observer	OSS	Research	Total
1990	422			185		607
1991	448			167	1	616
1992	330			205	1	536
1993	183			421		604
1994	223			228	14	465
1995	138			244	108	490
1996	127	868	49		69	1,113
1997	78	1,443			114	1,635
1998	225	1,376			98	1,699
1999	49	1,388	89		198	1,724
2000	34	1,387	108		177	1,706
2001	47	1,455	96		190	1,788
2002	17	1,339	84		181	1,621
2003	58	1,292	56		199	1,605
Average	**170**	**1,319**	**80**	**242**	**113**	**1,123**

Table 15. Herring catch at age for the 2003 purse seine, gillnet and weir fisheries conducted on the southwest Nova Scotia spawning component (4WX stock).

SW Nova Scotia Stock	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	459	486,345	342,592	114,850	96,847	13,111	7,136	435	23	-	-	1,061,798
% numbers	0%	46%	32%	11%	9%	1%	1%	0%	0%	0%	0%	100%
Catch wt. (t)	10	20,611	29,017	17,144	17,647	2,949	1,845	128	7	-	-	89,358
% catch wt.	0%	23%	32%	19%	20%	3%	2%	0%	0%	0%	0%	100%
Avg. len (cm)	14.7	18.2	23.1	27.2	28.7	30.6	31.8	33.5	34.9	-		22.0
Avg. wt. (g)	20.8	42.4	84.7	149.3	182.2	224.9	258.5	293.9	316.3	-		84.2

Catch Numbers (000's)	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Fall P. Seine (2002)	0	9,748	69,962	11,430	8,578	1,153	254	81	8	0		101,216
Winter P. Seine (2003)	0	73,889	16,367	668	31	0	0	0	0	0		90,956
P. Seine (2003)	453	388,618	252,698	101,175	87,004	11,827	6,717	344	14			848,851
Gillnet "Stock"	0	14	1,348	786	593	82	142	10				2,975
N.S. Weirs	6	14,076	2,216	790	641	49	22					17,800
Total Numbers by Age	459	486,345	342,592	114,850	96,847	13,111	7,136	435	23	0	0	1,061,798

% Numbers	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Fall P. Seine (2002)	0%	10%	69%	11%	8%	1%	0%	0%	0%	0%	0%	100%
Winter P. Seine (2003)	0%	81%	18%	1%	0%	0%	0%	0%	0%	0%	0%	100%
P. Seine (2003)	0%	46%	30%	12%	10%	1%	1%	0%	0%	0%	0%	100%
Gillnet "Stock"	0%	0%	45%	26%	20%	3%	5%	0%	0%	0%	0%	100%
N.S. Weirs	0%	79%	12%	4%	4%	0%	0%	0%	0%	0%	0%	100%
Percent Numbers by Age	0%	46%	32%	11%	9%	1%	1%	0%	0%	0%	0%	100%

Catch Weight (t)	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Fall P. Seine (2002)	0	208	3,798	1,077	1,133	191	51	18	2	0		6,477
Winter P. Seine (2003)	0	1,542	770	67	4	0	0	0	0	0		2,383
P. Seine (2003)	9	18,379	24,122	15,756	16,281	2,728	1,753	107	5			79,140
Gillnet "Stock"	0	1	147	122	110	19	36	3				438
N.S. Weirs	0	482	180	123	118	11	5					920
Total Weight (t) by Age	10	20,611	29,017	17,144	17,647	2,949	1,845	128	7	0	0	89,358

% Catch Weight	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Fall P. Seine (2002)	0%	3%	59%	17%	17%	3%	1%	0%	0%	0%	0%	100%
Winter P. Seine (2003)	0%	65%	32%	3%	0%	0%	0%	0%	0%	0%	0%	100%
P. Seine (2003)	0%	23%	30%	20%	21%	3%	2%	0%	0%	0%	0%	100%
Gillnet "Stock"	0%	0%	34%	28%	25%	4%	8%	1%	0%	0%	0%	100%
N.S. Weirs	0%	52%	20%	13%	13%	1%	1%	0%	0%	0%	0%	100%
Percent Weight by Age	0%	23%	32%	19%	20%	3%	2%	0%	0%	0%	0%	100%

Table 16. Herring catch at age by NAFO unit area for the 2003 summer purse seine fishery conducted on the southwest Nova Scotia spawning component (4WX stock).

Summer Purse - overall	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	453	388,618	252,698	101,175	87,004	11,827	6,717	344	14	-	-	848,851
% numbers	0%	46%	30%	12%	10%	1%	1%	0%	0%	0%	0%	100%
Catch wt. (t)	9	18,379	24,122	15,756	16,281	2,728	1,753	107	5	-	-	79,140
% catch wt.	0%	23%	30%	20%	21%	3%	2%	0%	0%	0%	0%	100%
Avg. len (cm)	14.8	18.9	23.4	27.2	28.7	30.6	31.8	33.5	34.9	-		22.5
Avg. wt. (g)	20.9	47.3	95.5	155.7	187.1	230.6	261.0	311.2	345.3	-		93.2

5Yb Purse	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	1	35,074	23,359	2,247	951	92	18	-	-	-	-	61,743
% numbers	0%	57%	38%	4%	2%	0%	0%	0%	0%	0%	0%	100%
Catch wt. (t)	0	1,764	1,928	321	173	21	4	-	-	-	-	4,211
% catch wt.	0%	42%	46%	8%	4%	0%	0%	0%	0%	0%	0%	100%
Avg. len (cm)	16.0	19.3	22.4	26.5	28.6	30.5	31.5	-	-	-		20.9
Avg. wt. (g)	26.6	50.3	82.6	142.7	181.5	225.8	250.2	-	-	-		68.2

4Xs Purse	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	362	182,837	27,907	2,049	693	35	16	1	-	-	-	213,900
% numbers	0%	85%	13%	1%	0%	0%	0%	0%	0%	0%	0%	100%
Catch wt. (t)	8	9,179	2,446	298	123	8	4	0	-	-	-	12,065
% catch wt.	0%	76%	20%	2%	1%	0%	0%	0%	0%	0%	0%	100%
Avg. len (cm)	15.0	19.3	22.8	26.7	28.5	30.5	31.3	33.0	-	-		19.8
Avg. wt. (g)	21.8	50.2	87.7	145.4	177.2	215.3	235.9	280.5	-	-		56.4

4Xr Purse	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	72	144,239	95,299	42,939	41,762	5,152	3,854	205	1	-	-	333,523
% numbers	0%	43%	29%	13%	13%	2%	1%	0%	0%	0%	0%	100%
Catch wt. (t)	1	6,382	8,294	6,793	7,807	1,195	1,019	65	0	-	-	31,556
% catch wt.	0%	20%	26%	22%	25%	4%	3%	0%	0%	0%	0%	100%
Avg. len (cm)	13.5	18.5	22.7	27.3	28.7	30.6	31.8	33.5	35.0	-		22.5
Avg. wt. (g)	15.5	44.2	87.0	158.2	186.9	231.9	264.3	315.8	355.8	-		94.6

4Xq Purse	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	19	26,468	106,133	53,940	43,598	6,548	2,830	138	13	-	-	239,687
% numbers	0%	11%	44%	23%	18%	3%	1%	0%	0%	0%	0%	100%
Catch wt. (t)	0	1,054	11,454	8,344	8,178	1,505	727	42	5	-	-	31,308
% catch wt.	0%	3%	37%	27%	26%	5%	2%	0%	0%	0%	0%	100%
Avg. len (cm)	15.5	17.7	24.3	27.1	28.7	30.6	31.7	33.5	34.9	-		25.3
Avg. wt. (g)	24.0	39.8	107.9	154.7	187.6	229.8	256.7	304.6	344.5	-		130.6

Table 17. Herring catch at age by month for the 2003 summer purse seine fishery conducted on the southwest Nova Scotia spawning component (4WX stock).

May - P. Seine	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	-	63,891	29,809	1,163	628	83	203	-	-	-	-	95,777
% numbers	0%	67%	31%	1%	1%	0%	0%	0%	0%	0%	0%	100%
Catch wt. (t)	-	2,008	1,905	136	113	18	49	-	-	-	-	4,229
% catch wt.	0%	47%	45%	3%	3%	0%	1%	0%	0%	0%	0%	100%
Avg. len (cm)	-	16.8	21.0	25.3	29.0	30.6	31.6	-	-	-		18.3
Avg. wt. (g)	-	31.4	63.9	117.1	180.5	216.6	239.1	-	-	-		44.2

June - P. Seine	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	-	24,669	28,385	3,356	1,397	17	65	-	-	-	-	57,889
% numbers	0%	43%	49%	6%	2%	0%	0%	0%	0%	0%	0%	100%
Catch wt. (t)	-	881	2,144	433	249	4	15	-	-	-	-	3,727
% catch wt.	0%	24%	58%	12%	7%	0%	0%	0%	0%	0%	0%	100%
Avg. len (cm)	-	17.6	21.9	25.8	28.5	30.5	30.9	-	-	-		20.5
Avg. wt. (g)	-	35.7	75.5	129.2	178.5	224.3	235.3	-	-	-		64.4

July - P. Seine	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	-	58,725	46,097	28,552	29,235	5,139	2,510	157	-	-	-	170,416
% numbers	0%	34%	27%	17%	17%	3%	1%	0%	0%	0%	0%	100%
Catch wt. (t)	-	2,865	4,591	4,582	5,665	1,209	674	49	-	-	-	19,637
% catch wt.	0%	15%	23%	23%	29%	6%	3%	0%	0%	0%	0%	100%
Avg. len (cm)	-	18.9	23.5	27.2	28.8	30.5	31.8	33.3	-	-		23.8
Avg. wt. (g)	-	48.8	99.6	160.5	193.8	235.3	268.7	315.4	-	-		115.2

Aug - P. Seine	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	-	20,547	51,158	38,569	33,816	3,629	2,416	88	1	-	-	150,225
% numbers	0%	14%	34%	26%	23%	2%	2%	0%	0%	0%	0%	100%
Catch wt. (t)	-	1,123	5,411	6,073	6,230	829	629	28	0	-	-	20,321
% catch wt.	0%	6%	27%	30%	31%	4%	3%	0%	0%	0%	0%	1.0
Avg. len (cm)	-	19.8	24.2	27.3	28.7	30.6	31.8	33.8	35.0	-		25.7
Avg. wt. (g)	-	54.6	105.8	157.5	184.2	228.3	260.2	316.2	355.8	-		135.3

Sept - P. Seine	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	26	85,228	73,472	26,230	19,924	2,804	1,430	93	13	-	-	209,221
% numbers	0%	41%	35%	13%	10%	1%	1%	0%	0%	0%	0%	100%
Catch wt. (t)	1	4,495	7,828	4,051	3,667	634	364	28	5	-	-	21,073
% catch wt.	0%	21%	37%	19%	17%	3%	2%	0%	0%	0%	0%	100%
Avg. len (cm)	14.5	19.5	24.2	27.2	28.7	30.6	31.7	33.4	34.9	-		23.2
Avg. wt. (g)	20.2	52.7	106.5	154.5	184.1	226.2	254.5	301.3	344.5	-		100.7

Oct - P. Seine	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	427	135,557	23,777	3,305	2,005	154	93	6	-	-	-	165,323
% numbers	0%	82%	14%	2%	1%	0%	0%	0%	0%	0%	0%	100%
Catch wt. (t)	9	7,007	2,243	480	356	34	23	2	-	-	-	10,153
% catch wt.	0%	69%	22%	5%	4%	0%	0%	0%	0%	0%	0%	100%
Avg. len (cm)	14.8	19.6	23.5	26.9	28.7	30.6	31.6	33.0	-	-		20.4
Avg. wt. (g)	20.9	51.7	94.3	145.3	177.7	219.2	243.2	280.5	-	-		61.4

Table 18. Catch at age (thousands) for the Southwest Nova Scotia / Bay of Fundy herring spawning component, 1965-2003.

	Age											
Year	1	2	3	4	5	6	7	8	9	10	11+	Total
1965	270,378	1,084,719	34,835	234,383	49,925	10,592	1,693	561	54	37	1	1,687,178
1966	154,323	914,093	448,940	73,382	321,857	45,916	13,970	7,722	1,690	215	1	1,982,109
1967	722,208	613,970	153,626	266,454	110,051	159,203	57,948	4,497	409	296	148	2,088,810
1968	164,703	2,389,061	224,956	83,109	290,285	73,087	90,617	31,977	15,441	5,668	1,175	3,370,079
1969	108,875	290,329	531,812	132,319	162,439	112,631	62,506	22,595	6,345	2,693	722	1,433,266
1970	699,720	576,896	76,532	286,278	201,215	120,280	111,937	41,257	21,271	7,039	2,674	2,145,099
1971	87,570	404,224	183,896	106,630	113,566	75,593	93,620	50,022	36,618	7,536	5,695	1,164,970
1972		649,254	71,984	148,516	77,207	75,384	49,065	48,700	26,055	13,792	11,679	1,171,636
1973	1,018	167,454	781,061	130,851	40,128	30,334	22,046	20,249	23,871	11,630	13,386	1,242,028
1974	18,411	766,064	93,606	803,651	68,276	19,093	10,232	6,565	12,786	7,102	9,031	1,814,817
1975	3,199	317,641	239,827	124,599	514,605	66,302	12,298	4,409	4,778	3,847	6,225	1,297,730
1976	240	55,596	206,535	153,782	68,804	268,839	21,460	5,571	3,951	2,059	3,446	790,283
1977	1,170	153,921	31,572	218,478	119,234	51,173	177,247	13,977	3,170	1,415	3,894	775,251
1978	35,381	383,611	40,887	12,906	122,108	68,410	31,088	108,975	11,082	2,425	1,676	818,549
1979	342	183,982	250,393	54,620	5,430	23,142	18,255	11,836	41,389	4,527	2,411	596,327
1980	2,339	12,503	80,518	474,091	27,930	4,373	4,692	6,560	2,985	10,641	2,739	629,371
1981		103,051	50,883	102,743	451,482	32,978	2,418	2,767	1,917	538	2,149	750,926
1982	3,589	102,133	150,764	22,640	98,206	211,043	14,627	2,080	1,354	1,250	1,014	608,700
1983	5,488	191,682	150,328	244,007	24,483	60,678	89,982	10,352	1,728	642	1,324	780,694
1984		88,433	243,542	224,354	146,096	22,716	21,654	28,299	9,515	2,183	9,000	795,792
1985	9,022	216,740	337,591	302,782	147,670	42,404	14,075	18,178	7,997	1,201	470	1,098,130
1986	63	125,300	275,903	292,792	56,937	31,599	10,770	4,320	2,942	1,356	349	802,331
1987	2,300	82,940	126,436	527,443	242,597	45,933	19,481	7,292	3,361	3,120	650	1,061,553
1988	151	148,399	113,208	195,096	434,192	236,089	42,533	21,208	4,186	3,797	2,845	1,201,704
1989	8	101,788	114,095	61,842	79,451	169,023	76,684	18,303	8,270	3,814	3,057	636,335
1990		178,532	130,176	171,560	89,922	101,066	201,901	116,788	31,466	10,572	6,848	1,038,831
1991		96,960	179,463	183,647	88,431	41,352	50,380	80,732	45,516	18,291	13,524	798,296
1992	9	168,561	132,642	286,923	126,510	75,473	34,458	35,369	59,136	34,558	20,653	974,292
1993	166	76,405	43,766	194,198	130,713	67,708	33,820	21,481	21,893	20,684	11,175	622,009
1994	151	103,885	142,260	53,700	118,015	72,512	36,059	14,889	8,706	10,447	15,533	576,157
1995	1,831	113,457	219,777	112,245	36,784	36,402	22,127	6,474	4,217	2,957	3,566	559,837
1996		37,496	37,715	256,063	54,534	16,862	9,151	3,300	1,782	1,310	1,605	419,818
1997	356	56,561	87,395	78,098	131,062	18,917	5,131	3,636	894	620	874	383,544
1998	137	264,901	62,322	138,751	97,065	97,464	20,679	3,856	1,730	1,288	398	688,591
1999	2,694	112,893	223,283	147,840	131,463	57,291	10,044	613	212	70	13	686,415
2000	841	364,078	75,330	108,560	124,083	60,754	25,829	4,454	251	33	23	764,236
2001	51	73,368	325,273	57,175	60,409	31,891	15,509	2,203	304	8	4	566,193
2002	15,500	303,723	98,597	210,620	75,258	27,973	12,846	1,577	70	23	3	746,188
2003	459	486,345	342,592	114,850	96,847	13,111	7,136	435	23			1,061,798

Table 19. Catch at age (%) for the Southwest Nova Scotia / Bay of Fundy herring spawning component, 1965-2003.

	Age											
Year	1	2	3	4	5	6	7	8	9	10	11+	Total
1965	16	64	2	14	3	1	0	0	0	0	0	100
1966	8	46	23	4	16	2	1	0	0	0	0	100
1967	35	29	7	13	5	8	3	0	0	0	0	100
1968	5	71	7	2	9	2	3	1	0	0	0	100
1969	8	20	37	9	11	8	4	2	0	0	0	100
1970	33	27	4	13	9	6	5	2	1	0	0	100
1971	8	35	16	9	10	6	8	4	3	1	0	100
1972	-	55	6	13	7	6	4	4	2	1	1	100
1973	0	13	63	11	3	2	2	2	2	1	1	100
1974	1	42	5	44	4	1	1	0	1	0	0	100
1975	0	24	18	10	40	5	1	0	0	0	0	100
1976	0	7	26	19	9	34	3	1	0	0	0	100
1977	0	20	4	28	15	7	23	2	0	0	1	100
1978	4	47	5	2	15	8	4	13	1	0	0	100
1979	0	31	42	9	1	4	3	2	7	1	0	100
1980	0	2	13	75	4	1	1	1	0	2	0	100
1981	-	14	7	14	60	4	0	0	0	0	0	100
1982	1	17	25	4	16	35	2	0	0	0	0	100
1983	1	25	19	31	3	8	12	1	0	0	0	100
1984	-	11	31	28	18	3	3	4	1	0	1	100
1985	1	20	31	28	13	4	1	2	1	0	0	100
1986	0	16	34	36	7	4	1	1	0	0	0	100
1987	0	8	12	50	23	4	2	1	0	0	0	100
1988	0	12	9	16	36	20	4	2	0	0	0	100
1989	0	16	18	10	12	27	12	3	1	1	0	100
1990	-	17	13	17	9	10	19	11	3	1	1	100
1991	-	12	22	23	11	5	6	10	6	2	2	100
1992	0	17	14	29	13	8	4	4	6	4	2	100
1993	0	12	7	31	21	11	5	3	4	3	2	100
1994	0	18	25	9	20	13	6	3	2	2	3	100
1995	0	20	39	20	7	7	4	1	1	1	1	100
1996	-	9	9	61	13	4	2	1	0	0	0	100
1997	0	15	23	20	34	5	1	1	0	0	0	100
1998	0	38	9	20	14	14	3	1	0	0	0	100
1999	0	16	33	22	19	8	1	0	0	0	0	100
2000	0	48	10	14	16	8	3	1	0	0	0	100
2001	0	13	57	10	11	6	3	0	0	0	0	100
2002	2	41	13	28	10	4	2	0	0	0	0	100
2003	0	46	32	11	9	1	1	0	0	-	-	100

Table 20. Average weights at age (g) for the SW Nova Scotia component of the 4WX herring fishery (weighted by fishery) for 1965-2003 (values for 1979-83 are averages for the period 1968-78 as in Iles et al. 1984).

	Age									
Year	1	2	3	4	5	6	7	8	9	10
1965	10	41	112	172	218	254	286	323	354	389
1966	10	41	112	172	218	254	286	323	354	389
1967	10	41	112	172	218	254	286	323	354	389
1968	10	33	112	148	185	244	276	399	338	410
1969	10	37	105	162	207	242	282	306	334	390
1970	10	32	119	169	211	257	292	332	369	389
1971	10	66	143	199	230	254	293	329	362	388
1972	10	44	138	192	223	262	292	322	345	380
1973	10	29	106	143	225	252	279	331	360	389
1974	10	48	110	175	206	240	277	322	342	352
1975	10	21	94	179	216	240	268	333	358	379
1976	10	33	114	159	233	249	277	317	382	404
1977	10	65	113	174	214	274	293	325	328	416
1978	10	28	112	181	229	259	302	330	351	397
1979	10	41	112	172	218	254	286	323	354	389
1980	10	41	112	172	218	254	286	323	354	389
1981	10	41	112	172	218	254	286	323	354	389
1982	10	41	112	172	218	254	286	323	354	389
1983	10	41	112	172	218	254	286	323	354	389
1984	10	38	132	191	229	259	280	296	309	364
1985	10	53	118	204	249	278	315	334	344	440
1986	10	55	124	182	239	271	306	329	360	400
1987	12	50	98	153	199	245	274	290	318	350
1988	13	21	88	154	196	242	281	304	327	341
1989	7	33	79	162	207	238	274	303	324	353
1990	10	31	92	161	200	234	255	287	319	336
1991	10	48	100	147	186	217	251	270	303	322
1992	9	25	100	148	181	216	252	275	295	313
1993	18	29	108	153	188	215	251	279	302	324
1994	12	37	79	131	175	203	223	253	289	304
1995	15	42	76	136	187	223	247	293	300	326
1996	10	33	98	137	168	228	266	308	332	355
1997	19	34	80	161	190	238	284	314	358	376
1998	10	38	76	131	177	210	251	296	308	337
1999	20	42	75	120	172	220	263	304	344	378
2000	26	61	95	138	171	206	235	269	316	360
2001	22	58	108	150	190	227	268	293	327	370
2002	18	45	106	148	185	221	255	285	334	398
2003	21	42	85	149	182	225	259	294	316	

Table 20. Average weights at age (g) for the SW Nova Scotia component of the 4WX herring fishery (weighted by fishery) for 1965-2003 (values for 1979-83 are averages for the period 1968-78 as in Iles et al. 1984).

	Age									
Year	1	2	3	4	5	6	7	8	9	10
1965	10	41	112	172	218	254	286	323	354	389
1966	10	41	112	172	218	254	286	323	354	389
1967	10	41	112	172	218	254	286	323	354	389
1968	10	33	112	148	185	244	276	399	338	410
1969	10	37	105	162	207	242	282	306	334	390
1970	10	32	119	169	211	257	292	332	369	389
1971	10	66	143	199	230	254	293	329	362	388
1972	10	44	138	192	223	262	292	322	345	380
1973	10	29	106	143	225	252	279	331	360	389
1974	10	48	110	175	206	240	277	322	342	352
1975	10	21	94	179	216	240	268	333	358	379
1976	10	33	114	159	233	249	277	317	382	404
1977	10	65	113	174	214	274	293	325	328	416
1978	10	28	112	181	229	259	302	330	351	397
1979	10	41	112	172	218	254	286	323	354	389
1980	10	41	112	172	218	254	286	323	354	389
1981	10	41	112	172	218	254	286	323	354	389
1982	10	41	112	172	218	254	286	323	354	389
1983	10	41	112	172	218	254	286	323	354	389
1984	10	38	132	191	229	259	280	296	309	364
1985	10	53	118	204	249	278	315	334	344	440
1986	10	55	124	182	239	271	306	329	360	400
1987	12	50	98	153	199	245	274	290	318	350
1988	13	21	88	154	196	242	281	304	327	341
1989	7	33	79	162	207	238	274	303	324	353
1990	10	31	92	161	200	234	255	287	319	336
1991	10	48	100	147	186	217	251	270	303	322
1992	9	25	100	148	181	216	252	275	295	313
1993	18	29	108	153	188	215	251	279	302	324
1994	12	37	79	131	175	203	223	253	289	304
1995	15	42	76	136	187	223	247	293	300	326
1996	10	33	98	137	168	228	266	308	332	355
1997	19	34	80	161	190	238	284	314	358	376
1998	10	38	76	131	177	210	251	296	308	337
1999	20	42	75	120	172	220	263	304	344	378
2000	26	61	95	138	171	206	235	269	316	360
2001	22	58	108	150	190	227	268	293	327	370
2002	18	45	106	148	185	221	255	285	334	398
2003	21	42	85	149	182	225	259	294	316	

Table 21. An evaluation of 2003 fishery observations for the SW Nova Scotia spawning component progress against biological objectives in the management plan for the fishery. (DFO 2003b).

	Objective	Met	Not Met
1	**Maintain reproductive capacity**		
1a	Persistence of all spawning components	German Bank and Scots Bay OK; Trinity recovering	Limited signs of Seal Island component Increased fishing on juveniles of mixed origin inconsistent with this objective
1b	Maintain biomass of each component	German Bank and Scots Bay	Trinity Ledge and Seal Island
1c	Maintain broad age composition		Not met in all areas Few fish older than age 7; only 20% 4+. Rapid decline of year-classes (including strong 1998 year-class)
1d	Maintain long spawning period	German Bank and Scots Bay	Trinity and Seal Island
2	**Prevent growth over-fishing**		
2a	Fishing mortality at or below F0.1	Landings in recent years less than 20% of surveyed SSB	High total mortality and targeting of 2 year olds
3	**Maintain ecosystem integrity / ecological relationships**		
3a	Maintain spatial and temporal diversity of spawning	German Bank and Scots Bay	Insufficient spawning at Seal Island and Trinity Ledge
3b	Maintain biomass at moderate to high levels	Acoustic surveys indicate moderate SSB	

Table 22. 2003 4WX offshore herring fisheries catch at age in number (thousands) and weight (t).

4WX Offshore Purse Seine

	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	-	0	1,391	1,658	2,134	78	305	5	3	-	-	5,574
% numbers	0%	0%	25%	30%	38%	1%	5%	0%	0%	0%	0%	100%
Catch wt. (t)	-	0	148	244	389	18	76	2	1	-	-	878
% catch wt.	0%	0%	17%	28%	44%	2%	9%	0%	0%	0%	0%	100%
Avg. len (cm)	-	21.2	24.4	26.9	28.7	30.7	31.5	34.4	35.5	-		27.3
Avg. wt. (g)	-	65.7	106.4	146.9	182.5	229.9	250.2	337.2	375.0	-		157.5

4W Midwater Trawl

	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	-	-	-	25	109	15	97	4	-	-	-	250
% numbers	0%	0%	0%	10%	44%	6%	39%	2%	0%	0%	0%	100%
Catch wt. (t)	-	-	-	4	20	3	24	1	-	-	-	52
% catch wt.	0%	0%	0%	7%	39%	6%	45%	2%	0%	0%	0%	100%
Avg. len (cm)	-	-	-	27.5	29.2	30.8	31.7	33.7	-	-		30.2
Avg. wt. (g)	-	-	-	152.1	185.2	220.2	243.5	295.1	-	-		208.4

4WX Misc. gears

	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	1	1,001	346	54	37	6	5	0	0	-	-	1,450
% numbers	0%	69%	24%	4%	3%	0%	0%	0%	0%	0%	0%	100%
Catch wt. (t)	0	30	22	7	6	1	1	0	0	-	-	68
% catch wt.	0%	44%	32%	10%	9%	2%	2%	0%	0%	0%	0%	100%
Avg. len (cm)	14.1	16.4	21.1	26.2	28.7	30.6	31.8	33.3	34.6	-		18.3
Avg. wt. (g)	18.7	30.2	63.5	127.1	172.0	214.3	239.6	273.0	306.7	-		46.9

Table 23. Herring abundance indices: larval abundance index (average number of larvae per m² from 79 index stations) and herring by-catch (stratified numbers per tow) from the July groundfish survey.

	Larval Herring Bongo Survey No.per m2 to bottom				July ground trawl survey by-catch for herring (stratified mean numbers)											
					4WX area combined strata 453/495				4W Only strata 453/466		4X Only strata 470/495		Offshore Banks strata 455/478		4V only strata 442/452	
Year	Cruise	Mean	SE	N	Cruise	Mean#	SE	N	Mean#	SE	Mean#	SE	Mean#	SE	Mean#	SE
1970					A175/176	4.1	1.5	95	4.9	2.4	1.6	0.6	5.7	2.4	12.8	9.8
1971					A188/189	4.0	1.9	86	2.6	1.2	3.6	2.6	5.3	2.8	4.4	4.4
1972	P109	9.4	1.8	79	A200/201	1.4	0.6	105	1.7	1.0	0.5	0.1	2.0	1.0	4.5	3.7
1973	P127	6.6	1.3	79	A212/213	0.9	0.3	96	0.4	0.3	1.0	0.4	0.9	0.4	19.2	19.2
1974	P147	49.5	10.9	79	A225/226	0.7	0.3	102	0.2	0.0	1.0	0.4	0.5	0.2	0.0	0.0
1975	P160	11.7	1.5	58	A236/237	0.9	0.4	104	0.8	0.4	0.7	0.4	0.7	0.4	2.2	2.2
1976	P175	13.5	2.9	79	A250/251	0.4	0.2	103	0.1	0.1	0.5	0.3	0.1	0.1	0.0	0.0
1977	P190	6.3	1.0	79	A265/266	0.5	0.3	106	0.0	0.0	0.8	0.5	0.1	0.1	1.6	1.4
1978	P207	4.5	0.5	77	A279/280	0.3	0.3	103	0.5	0.5	0.1	0.0	0.5	0.5	0.0	0.0
1979	P232	7.1	2.1	79	A292/293	0.6	0.5	106	0.0	0.0	1.0	0.7	0.2	0.2	0.0	0.0
1980	P246	26.2	6.7	79	A306/307	0.5	0.5	105	0.0	0.0	0.8	0.8	0.0	0.0	0.0	0.0
1981	P263	2.7	0.3	78	A321/322	1.5	1.4	104	0.0	0.0	2.3	2.1	0.0	0.0	0.0	0.0
1982	P280	10.6	1.2	77	H080/081	1.5	0.9	108	0.5	0.3	1.9	1.4	2.5	1.7	0.0	0.0
1983	P298	13.9	1.6	74	N012/013	2.4	0.8	106	2.6	1.2	2.2	1.0	2.1	1.0	0.1	0.0
1984	P315	12.7	1.4	78	N031/032	7.0	3.5	102	3.3	1.2	10.5	6.8	8.5	5.4	4.0	2.9
1985	P329	40.8	4.6	79	N048/049	3.4	1.8	111	6.6	3.8	0.3	0.1	5.0	2.9	0.0	0.0
1986	P344	18.9	2.1	78	N065/066	23.2	14.9	118	30.8	26.7	16.0	14.3	23.4	20.3	0.5	0.4
1987	P361	27.9	3.2	78	N85/86/87	10.4	5.6	135	17.0	11.3	4.0	1.8	12.9	8.6	117.4	90.5
1988	P377	100.7	11.5	76	N105/106	2.1	0.6	127	2.7	1.2	1.5	0.5	2.0	0.9	0.3	0.2
1989	P391	54.5	6.1	79	N123/124	8.4	1.8	124	11.8	3.4	4.5	1.2	9.8	2.7	3.6	3.1
1990	P408	27.2	3.1	79	N139/140	5.6	1.9	156	7.4	3.6	3.4	1.0	6.5	2.9	0.3	0.2
1991	P422	48.2	5.5	78	N154/H231	10.6	5.8	137	13.0	8.8	5.0	1.8	14.3	9.0	10.2	9.9
1992	P437	57.0	6.4	79	N173/174	16.5	4.9	136	16.2	6.6	40.8	15.7	23.6	7.4	0.2	0.1
1993	P451	55.0	6.2	78	N189/190	18.7	4.5	137	6.3	2.5	30.4	8.5	15.0	4.7	1.0	0.6
1994	N211	5.4	0.7	77	N221/222	76.4	30.2	140	108.4	58.9	45.9	18.4	91.1	45.1	25.7	22.0
1995	N232	20.3	4.6	78	N226/227	63.5	24.2	140	100.5	47.9	28.4	12.8	92.7	37.6	7.9	6.1
1996	N252	9.5	1.6	77	N246/247	40.2	14.2	135	53.2	24.5	27.1	14.1	46.5	19.5	0.2	0.1
1997	N765	23.3	2.7	77	N726/734	31.8	15.3	137	34.6	10.1	51.3	39.3	29.3	7.7	0.2	0.1
1998	N865	33.6	3.8	77	N827/832	99.52	20.65	131	147.6	39.92	54.76	14.5	130.3	30.3	0.8	0.3
1999	no survey				N925/929	229.8	83.8	133	264.2	101.0	199.4	130.2	226.2	74.4	24.9	15.2
2000	no survey				N426/431	90.6	20.0	146	146.3	40.6	38.7	7.4	124.7	30.5	2.0	0.6
2001	no survey				N2001-032/037	145.9	47.7	139	152.7	81.3	139.5	52.5	132.4	60.9	53.9	49.2
2002	no survey				N2002-037/040	161.9	48.6	147	172.7	81.3	151.9	55.6	162.6	61.1	4.9	2.6
2003	no survey				N2003-036/042	130.6	70.5	153	207.8	145.4	58.7	14.5	175.8	108.6	4.9	2.0

Table 24. Stratified mean numbers per tow by age of herring for unit area 4WX (strata 53/95) from the DFO July research survey.

Year	1	2	3	4	5	6	7	8	9	10	11+	Unkown	TOTAL
1970			0.1	1.6	1.2	0.8	0.2	0.1	0.0				4.0
1971			0.4	0.8	1.3	0.7	0.5	0.0	0.0	0.0	0.0	0.1	3.9
1972		0.1	0.0	0.2	0.3	0.4	0.2	0.1	0.0	0.0	0.0	0.1	1.4
1973			0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.1	0.9
1974		0.0	0.1	0.5	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.8
1975		0.0	0.1	0.2	0.3	0.1	0.0	0.0	0.0	0.0	0.1		0.9
1976		0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0		0.4
1977		0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0			0.3	0.5
1978	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0		0.4
1979		0.0	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.6
1980	0.0	0.0	0.0	0.0	0.0	0.0						0.5	0.5
1981	0.1	0.1	0.4	0.7	0.2	0.0	0.0	0.0	0.0	0.0		0.0	1.5
1982		0.1	0.3	0.3	0.7	0.4	0.0	0.0	0.0	0.0	0.0	0.0	1.9
1983	0.0	0.6	0.2	0.6	0.1	0.3	0.3	0.1	0.0	0.0	0.0	0.0	2.4
1984	0.0	0.1	0.4	0.8	1.2	0.3	0.3	0.3	0.0	0.1	3.5	0.0	7.0
1985		0.1	0.2	1.1	1.0	0.6	0.2	0.2	0.1	0.0	0.0	0.0	3.4
1986		0.2	7.2	7.2	4.7	2.4	1.1	0.2	0.1	0.1	0.1	0.0	23.4
1987	0.0	1.0	3.7	2.7	1.1	0.8	0.4	0.3	0.2	0.1	0.1		10.4
1988		0.3	0.1	0.4	0.7	0.4	0.1	0.0	0.0	0.0	0.0	0.0	2.1
1989	0.2	0.2	0.4	0.8	1.0	2.9	1.7	0.3	0.1	0.1	0.1	0.1	8.0
1990	0.1	0.2	0.6	0.8	0.7	0.7	1.3	0.7	0.1	0.0	0.1	0.0	5.3
1991		0.1	0.5	1.6	1.9	1.1	1.6	2.7	0.9	0.2	0.1	0.0	10.9
1992		11.6	1.3	1.8	2.8	4.1	2.1	1.9	2.6	0.6	0.3	0.1	29.1
1993		0.1	0.8	3.1	4.2	4.1	3.1	1.3	0.9	0.8	0.4		18.8
1994		0.1	5.1	9.5	23.2	18.4	7.0	0.5	1.4	3.4	1.2	6.1	75.9
1995	0.0	0.5	10.7	13.1	9.4	13.8	9.2	3.3	1.6	1.0	1.3	0.1	63.9
1996	0.0	0.3	1.8	19.1	7.9	5.3	3.2	1.1	0.3	0.2	0.2	0.0	39.4
1997	1.2	20.0	1.8	5.7	9.1	2.0	1.2	0.6	0.2	0.1	0.3	0.9	43.2
1998	0.1	1.5	2.4	22.0	37.8	28.4	5.2	1.4	0.4	0.2	0.2	0.0	99.5
1999	0.2	7.3	59.5	32.6	92.9	29.8	2.3	0.1	0.0	0.0		0.1	224.7
2000	0.1	1.2	9.1	31.7	30.8	13.2	4.0	0.4	0.0	0.0		0.0	90.6
2001		5.3	95.0	14.1	22.7	7.2	1.3	0.1	0.0			0.0	145.8
2002	1.8	34.9	41.8	56.9	18.4	5.1	2.4	0.4	0.0	0.0		0.2	161.9
2003		0.2	4.5	23.5	56.8	37.5	5.5	1.9	0.0			0.7	130.6

Table 25. Herring by-catch (numbers and weight per tow; stratified mean numbers and weight) from the spring 4VsW ground trawl survey.

YEAR	MISSION	Start Date	End Date	Number of Sets	Min. Strata	Max. Strata	Mean No. per Tow	Mean Distance Weighted No per Tow	Mean Distance Weighted Weight per Tow (kg)	Stratified Mean Number	Stratified Mean Weight (kg)
1986	NED1986060	18-Mar-86	25-Mar-86	81	401	411	12.63	12.49	1.47	15.0	1.5
1987	NED1987078	24-Mar-87	01-Apr-87	94	401	411	60.77	92.18	14.69	87.9	14.0
1988	NED1988098	22-Mar-88	29-Mar-88	69	401	411	62.54	64.44	12.95	131.6	26.8
1989	NED1989117	13-Mar-89	21-Mar-89	84	402	411	19.35	19.70	4.45	27.3	6.1
1990	NED1990134	13-Mar-90	21-Mar-90	82	401	411	209.74	216.89	44.97	172.4	30.7
1991	NED1991149	05-Mar-91	18-Mar-91	100	401	411	7.27	7.35	1.48	8.5	1.6
1992	NED1992166	14-Mar-92	23-Mar-92	78	401	411	7.35	7.13	1.47	6.4	1.3
1993	NED1993182	03-Mar-93	13-Mar-93	79	397	411	50.13	48.71	11.55	36.2	7.9
1994	NED1994201	27-Feb-94	10-Mar-94	104	397	411	29.38	29.82	7.31	20.4	4.2
1995	NED1995217	27-Feb-95	12-Mar-95	129	396	446	41.76	41.53	2.56	36.4	2.2
1996	NED1996238	03-Mar-96	10-Mar-96	52	397	410	88.98	87.25	11.27		
1997	NED1997255	08-Mar-97	23-Mar-97	127	397	411	24.03	23.32	4.13	28.0	4.7
1998	no survey										
1999	NED1999872	02-Mar-99	21-Mar-99	122	397	481	38.16	38.10	5.70	42.1	5.8
2000	NED2000966	01-Mar-00	16-Mar-00	120	397	411	40.21	40.84	5.95	49.7	6.8
2001	NED2001004	28-Feb-01	13-Mar-01	92	397	411	242.32	237.67	23.36	305.4	28.1
2002	NED2002003	05-Mar-02	19-Mar-02	130	397	460	47.62	47.47	5.02		
2003	NED2003003	04-Mar-03	20-Mar-03	110	399	411	127.55	126.91	16.02	115.5	12.6

Table 26. Recorded landings (t) of herring from major gillnet fisheries on the Coastal Nova Scotia Spawning component.

Landings (t)	1996	1997	1998	1999	2000	2001	2002	2003
Little Hope/Port Mouton		490	1,170	2,919	2,043	2,904	3,982	4,526
Halifax/Eastern Shore	1,280	1,520	1,100	1,628	1,350	1,898	3,334	2,727
Glace Bay		170	1,730	1,040	834	1,204	3,058	1,905
Bras d'Or Lakes	170	160	120	31	56	0	1	4
Total	1,450	2,340	4,120	5,618	4,283	6,006	10,375	9,162

Table 27. Summary of the estimated spawning biomass of herring from major gillnet fisheries in the Coastal Nova Scotia Spawning component. Total SSB is rounded to nearest 100t.

Survey SSB (t)	1996	1997	1998	1999	2000	2001	2002	2003
Little Hope/Port Mouton			14,100	15,800	5,200	21,300	56,000	63,700
Halifax/Eastern Shore			8,300	20,200	10,900	16,700	41,500	77,400
Glace Bay				2,000		21,200	7,700	31,500
Bras d'Or Lakes				530	70			

Table 28. Summary of the exploitation of herring from major gillnet fisheries in the Coastal Nova Scotia Spawning component. Exploitation is calculated as (Landings / SSB)

Exploitation (Landings/SSB)	1996	1997	1998	1999	2000	2001	2002	2003
Little Hope/Port Mouton			8%	18%	39%	14%	7%	7%
Halifax/Eastern Shore			13%	8%	12%	11%	8%	4%
Glace Bay				52%		6%	40%	6%
Bras d'Or Lakes				6%	80%			

Table 29. Gillnet effort, catch and CPUE for the Little Hope/Port Mouton area for landings in Sept. and Oct. from statistical districts 28 and 30.

Year	No. Days Fished	No. of Boats Fishing	Total Catch t	CPUE Catch/Day	CPUE Catch/Boat
1997	92	17	480	5.2	28.2
1998	291	30	1,126	3.9	37.5
1999	680	44	3,011	4.4	68.4
2000	378	51	2,051	5.4	40.2
2001	636	53	2,873	4.5	54.2
2002	1028	75	3,954	3.8	52.7
2003	649	89	4,480	6.9	50.3

Table 30. Gillnet effort, catch and CPUE for the Eastern Shore/Halifax area from landings in Sept. and Oct. for statistical districts 18, 20, 21 and 22.

Year	No. Days Fished	No. of Boats Fishing	Total Catch t	CPUE Catch/Day	CPUE Catch/Boat
1997	225	28	1,576	7.0	56.3
1998	264	30	1,105	4.2	36.8
1999	273	31	1,642	6.0	53.0
2000	195	29	1,365	7.0	47.1
2001	305	34	1,884	6.2	55.4
2002	567	41	3,413	6.0	83.2
2003	421	52	2,737	6.5	52.6

Table 31. Gillnet effort, catch and CPUE for the Glace Bay area from landings in Sept. and Oct. for statistical districts 4, 6 and 7.

Year	No. Days Fished	No. of Boats Fishing	Total Catch t	CPUE Catch/Day	CPUE Catch/Boat
1997	28	6	205	7.3	34.2
1998	271	27	1,544	5.7	57.2
1999	177	31	1,114	6.3	35.9
2000	115	21	859	7.5	40.9
2001	162	19	1,218	7.5	64.1
2002	269	24	3,059	11.4	127.4
2003	236	44	1,905	8.1	43.3

Table 32. Catch at age for herring from Coastal Nova Scotia fisheries in 2003.

4X Little Hope/Port Mouton Gillnet

	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	-	-	204	3,224	10,002	4,194	4,371	343	7	-	-	22,344
% numbers	0%	0%	1%	14%	45%	19%	20%	2%	0%	0%	0%	100%
Catch wt. (t)	-	-	26	512	1,872	921	1,097	96	2	-	-	4,526
% catch wt.	0%	0%	1%	11%	41%	20%	24%	2%	0%	0%	0%	100%
Avg. len (cm)	-	-	25.8	27.7	29.1	30.6	31.9	33.0	33.8	-		29.8
Avg. wt. (g)	-	-	125.9	158.7	187.2	219.5	251.1	280.7	304.1	-		202.6

4W Halifax/Eastern Shore Gillnet

	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	-	-	-	921	5,259	2,985	2,979	384	31	-	-	12,560
% numbers	0%	0%	0%	7%	42%	24%	24%	3%	0%	0%	0%	100%
Catch wt. (t)	-	-	-	151	1,019	670	764	114	9	-	-	2,727
% catch wt.	0%	0%	0%	6%	37%	25%	28%	4%	0%	0%	0%	100%
Avg. len (cm)	-	-	-	27.9	29.4	30.7	31.9	33.4	33.5	-		30.3
Avg. wt. (g)	-	-	-	163.9	193.7	224.5	256.4	297.6	294.6	-		217.1

4Vn Gillnet Glace Bay

	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	-	-	-	28	827	1,540	3,056	1,054	778	95	-	7,377
% numbers	0%	0%	0%	0%	11%	21%	41%	14%	11%	1%	0%	100%
Catch wt. (t)	-	-	-	5	166	350	792	310	249	33	-	1,905
% catch wt.	0%	0%	0%	0%	9%	18%	42%	16%	13%	2%	0%	100%
Avg. len (cm)	-	-	-	28.4	29.5	30.7	32.1	33.6	34.6	35.6		32.0
Avg. wt. (g)	-	-	-	180.4	201.2	227.1	259.0	294.5	319.8	347.5		258.2

4Vn Gillnet Misc

	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	-	17	0	0	0	3	9	2	4	1	0	36
% numbers	0%	48%	0%	0%	0%	8%	24%	5%	10%	4%	0%	100%
Catch wt. (t)	-	1	0	0	0	1	2	0	1	0	0	6
% catch wt.	0%	18%	0%	0%	0%	11%	35%	8%	18%	8%	1%	99%
Avg. len (cm)	-	18.1	21.3	25.3	29.4	31.4	31.7	33.8	34.7	35.9	38.3	25.6
Avg. wt. (g)	-	61.5	95.1	141.2	201.9	237.0	244.2	284.6	304.2	329.5	385.7	166.4

Table 33. Summary of herring catches for the 4Vn inshore area (stratum 42) during the July groundfish survey;1990 to 2003 in numbers and weight (kg).

Year	Total Number	Average No. Per Set	Total Weight	Average Wt. Per Set
1990	1	0	0	0
1991	11	2	4	1
1992	0	0	0	0
1993	13	3	4	1
1994	1,301	217	432	72
1995	359	60	80	13
1996	0	0	0	0
1997	2	0	1	0
1998	37	7	6	1
1999	1,605	229	431	62
2000	42	7	11	2
2001	2,938	490	944	157
2002	91	18	26	5
2003	175	29	40	7

Note: strata 42 is entirely 4Vn inshore

Table 34. New Brunswick weir catch at age for herring in 2003.

NB Weirs (only)
Catch at age (numbers and weight)

	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	10,641	161,647	17,539	3,016	1,562	170	53	-	-	-	-	194,630
% numbers	5%	83%	9%	2%	1%	0%	0%	0%	0%	0%	0%	100%
Catch wt. (t)	141	6,470	1,609	445	288	38	13	-	-	-	-	9,004
% catch wt.	2%	72%	18%	5%	3%	0%	0%	0%	0%	0%	0%	100%
Avg. len (cm)	12.7	17.9	23.0	26.8	28.7	30.6	31.5	-	-	-		18.3
Avg. wt. (g)	13.2	40.0	91.7	147.6	184.1	225.9	249.2	-	-	-		46.3

Table 35. 5Z Georges Bank (Canadian portion) midwater trawl fishery catch at age for 2003.

5Ze Midwater Trawl

	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11+	Total
Numbers (x1,000)	-	22	199	1,485	4,833	1,599	1,079	15	-	-	-	9,232
% numbers	0%	0%	2%	16%	52%	17%	12%	0%	0%	0%	0%	100%
Catch wt. (t)	-	1	19	218	882	353	272	4	-	-	-	1,749
% catch wt.	0%	0%	1%	12%	50%	20%	16%	0%	0%	0%	0%	100%
Avg. len (cm)	-	20.0	23.6	27.0	28.8	30.5	31.7	32.7	-	-		29.0
Avg. wt. (g)	-	52.8	93.8	146.7	182.6	220.6	252.1	278.3	-	-		189.4

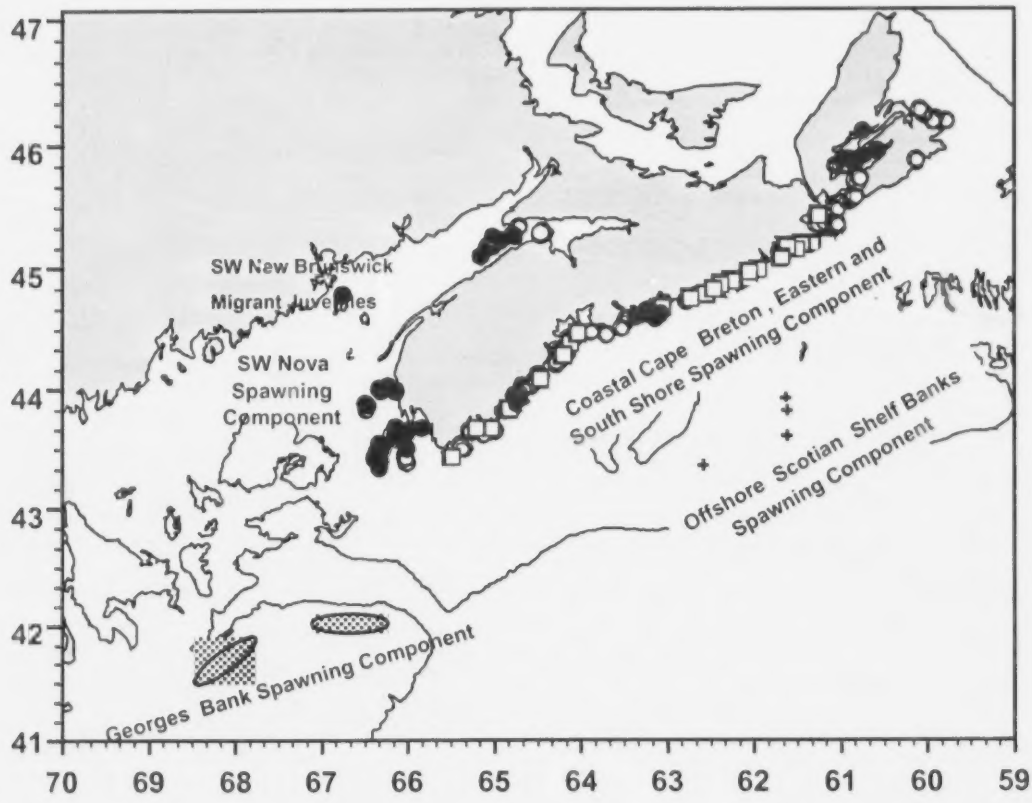


Figure 1. Management units for herring in areas 4VWX and 5 showing locations of known current (solid) and historical (open) spawning locations.

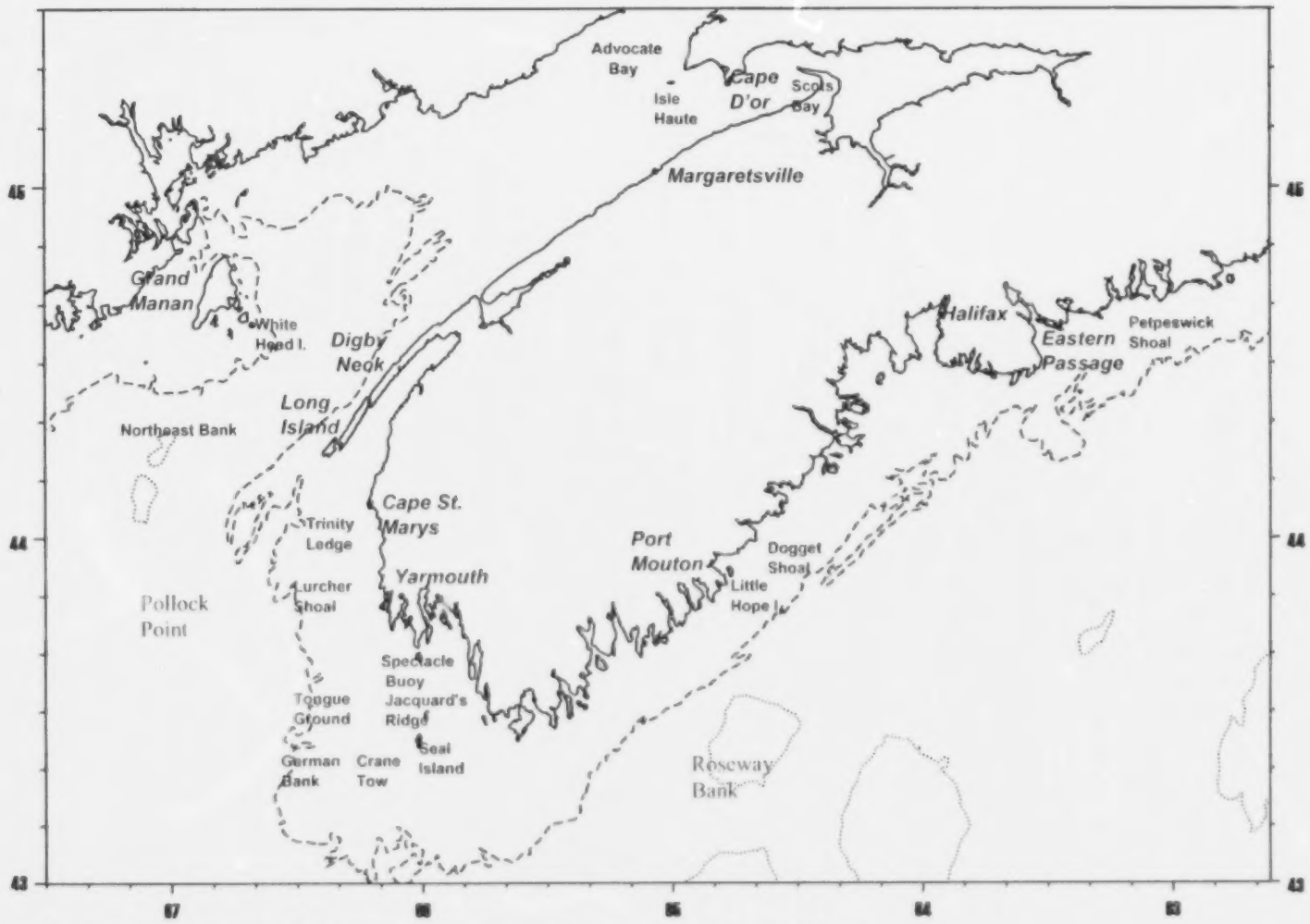


Figure 2. Fishing locations for herring in southwest and coastal Nova Scotia.

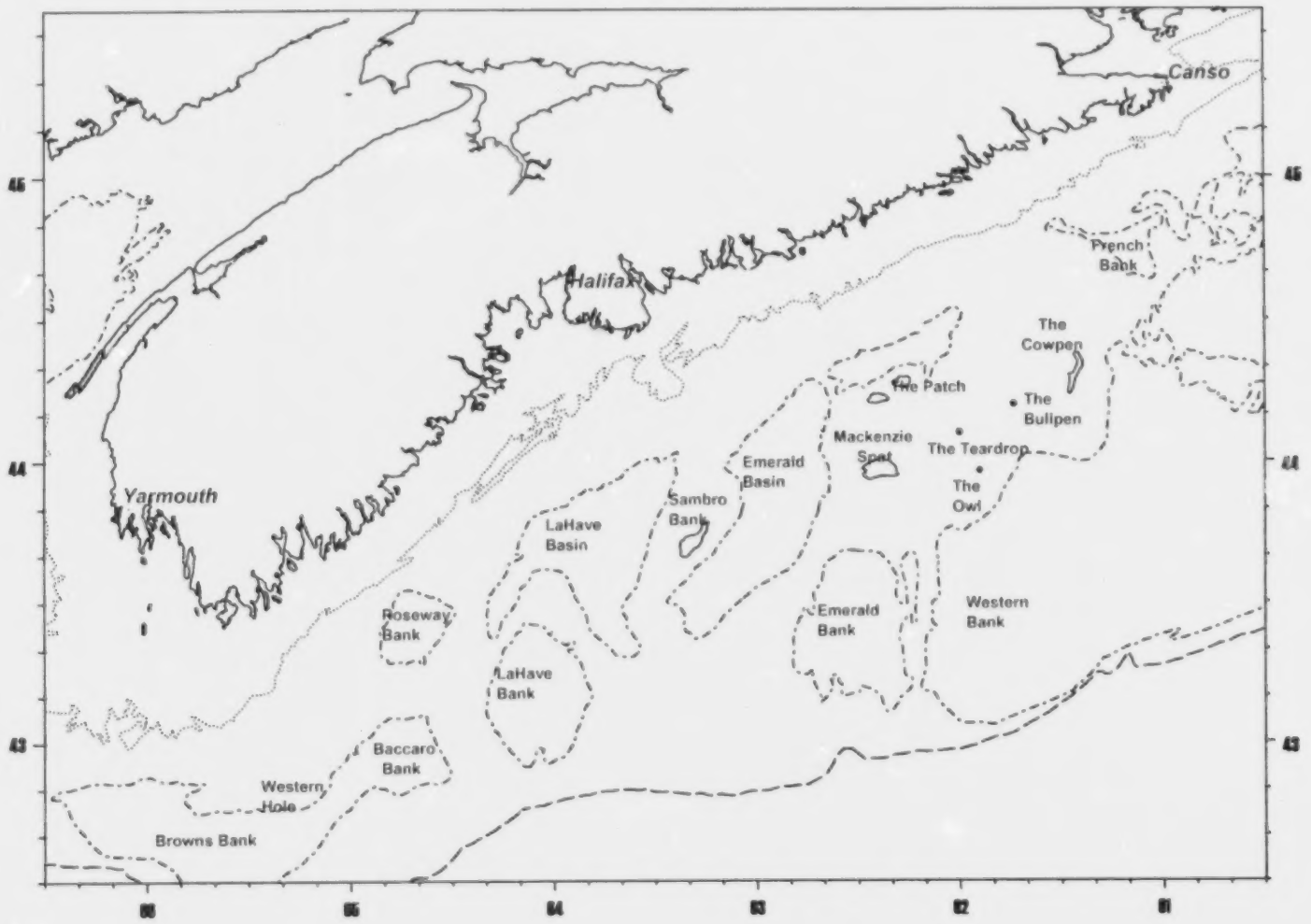


Figure 3. Fishing locations for herring on the offshore Scotian Shelf banks.

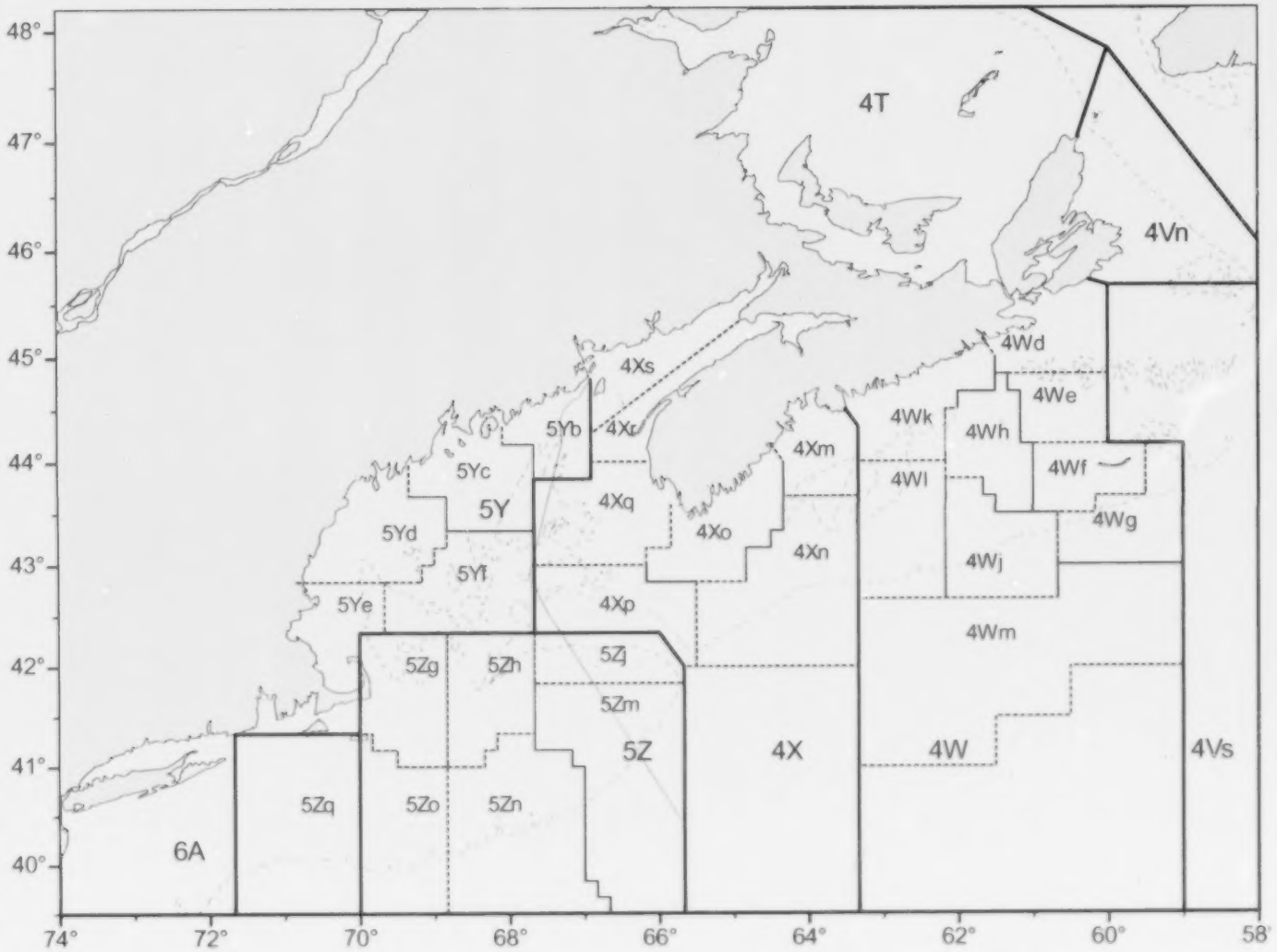


Figure 4. Major and minor NAFO unit areas as used for sample and catch data aggregation.

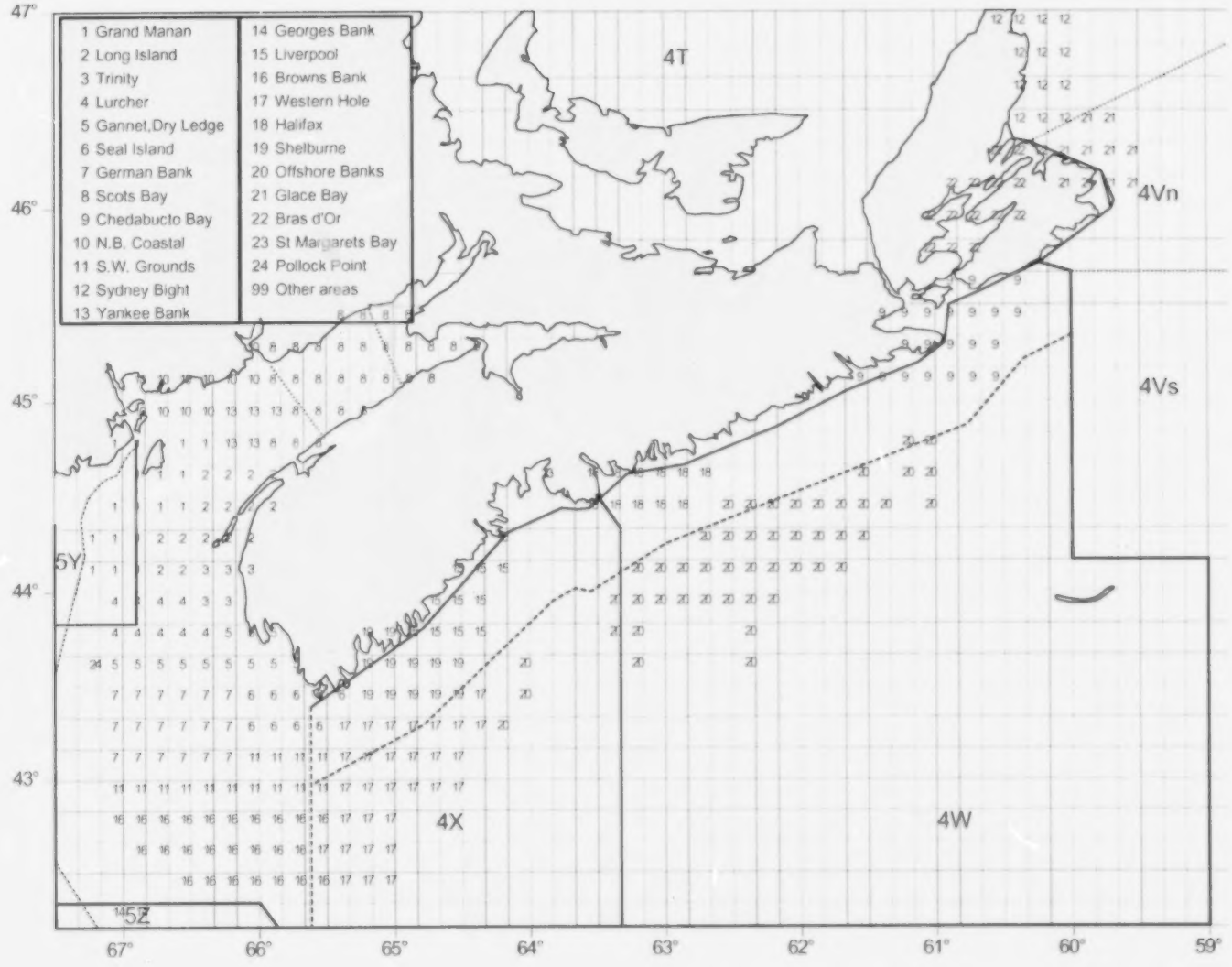


Figure 5. Herring fishing ground areas and management lines.

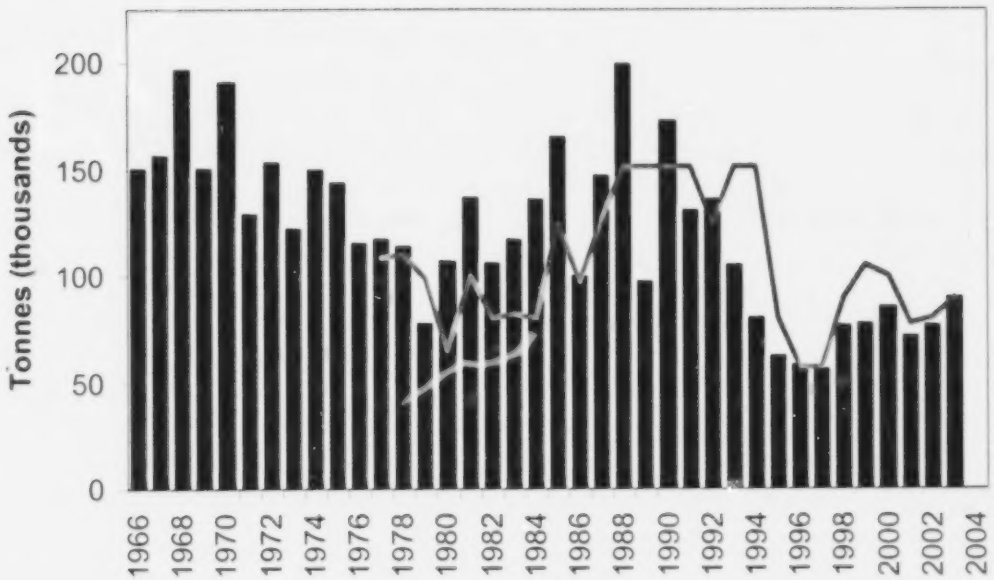


Figure 6. Annual herring landings [bars] and TAC [solid line] (quota) for the southwest Nova Scotia spawning component (4WX stock).

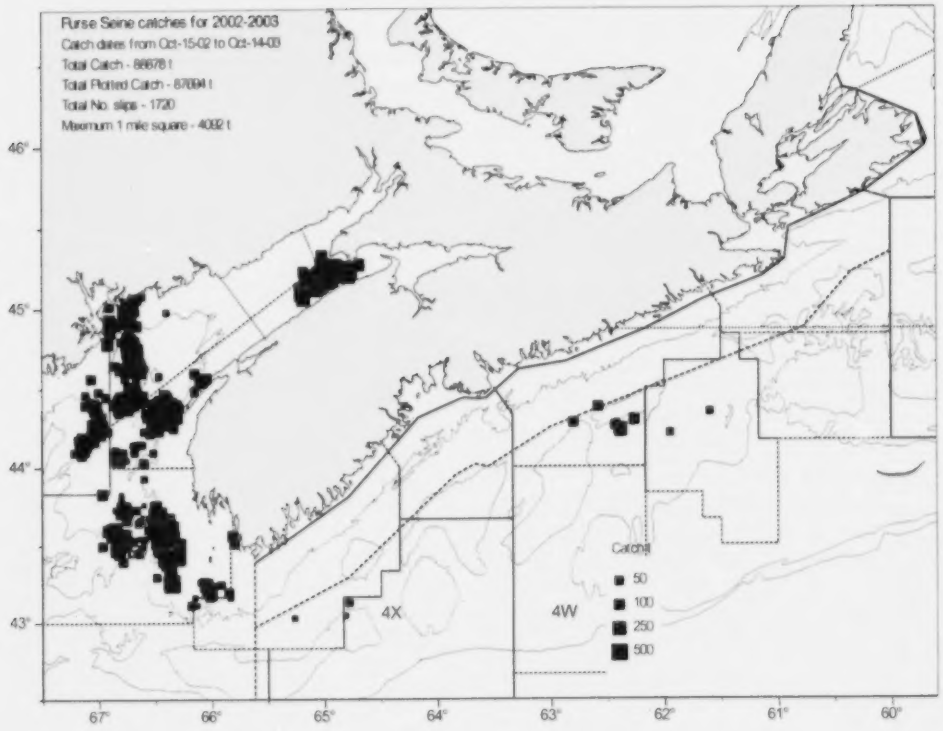


Figure 7. Overall 2002-2003 quota year herring purse seine catches (t) for NAFO areas 4WX (from Statistics Division MARFIS database).

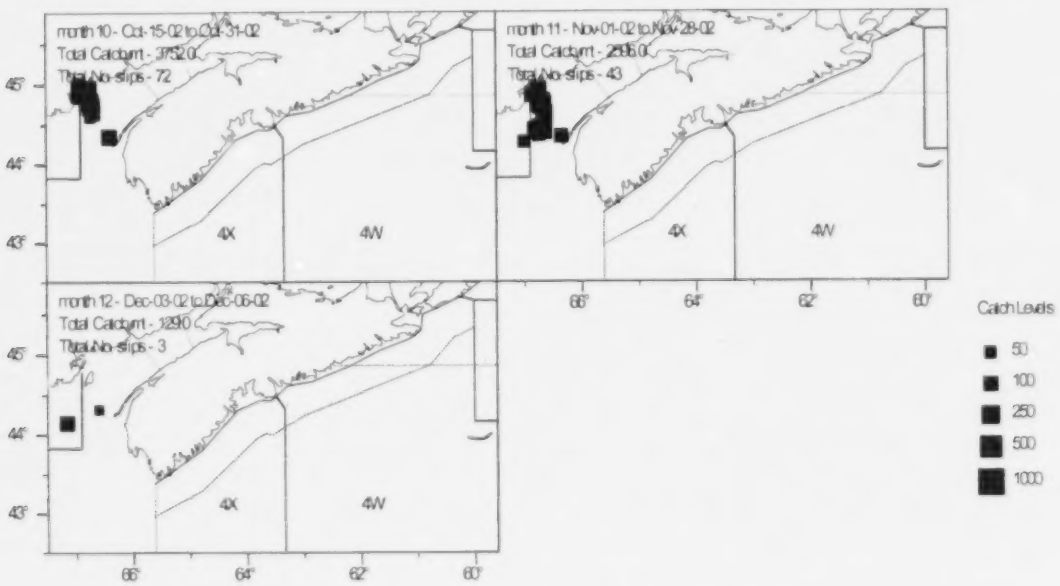


Figure 8. 2002 herring purse seine catches (t) by month in NAFO areas 4WX from 2002-2003 quota year (from Statistics Division MARFIS database).

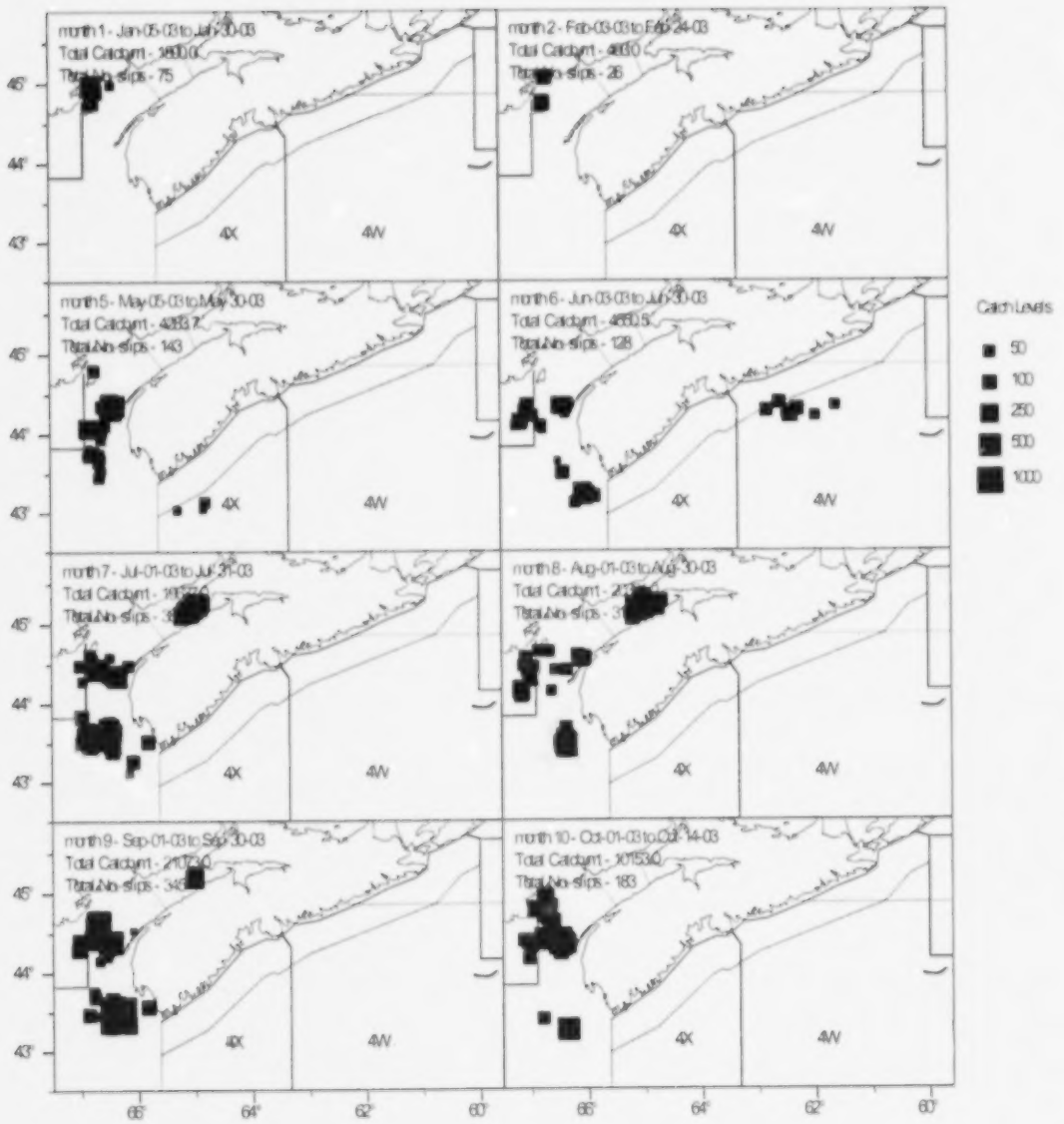


Figure 9. 2003 herring purse seine catches (t) by month in NAFO areas 4WX from 2002-2003 quota year (from Statistics Division MARFIS database).

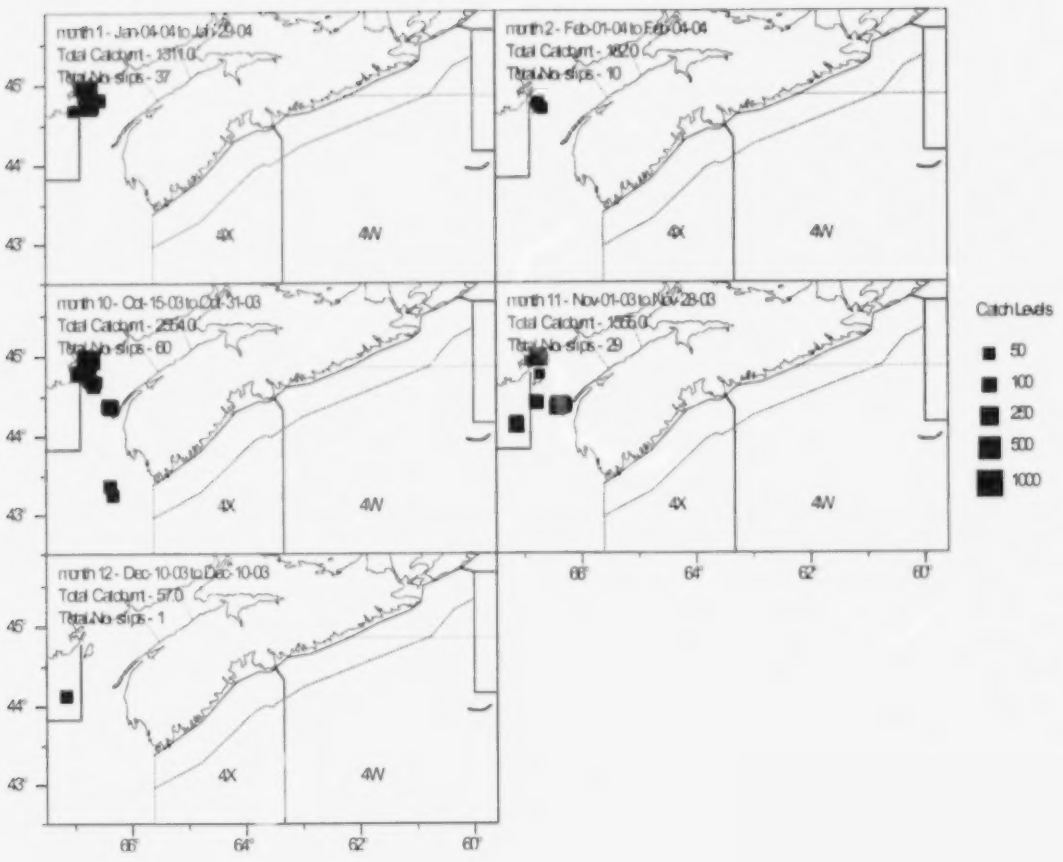


Figure 10. Herring purse seine catches (t) by month in NAFO areas 4WX for 2003-2004 quota year to date (from Statistics Division MARFIS database).

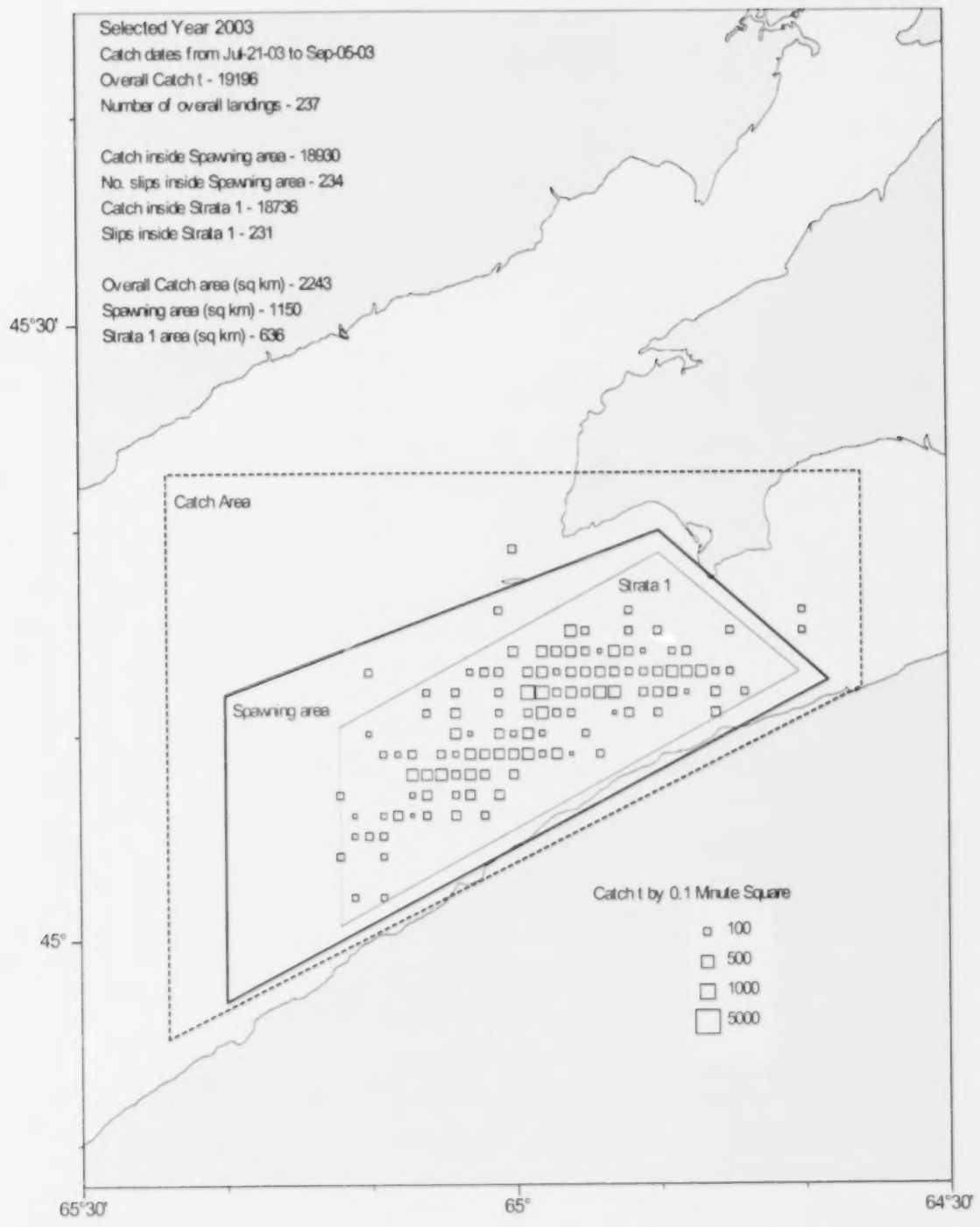


Figure 11. 2003 Scots Bay spawning fishery (catches t and area in km^2) for the spawning period July 21 to Sept. 5, 2003 in the selected 'Catch Area', 'Spawning Area' and the primary acoustic survey areas (Strata 1) as defined.

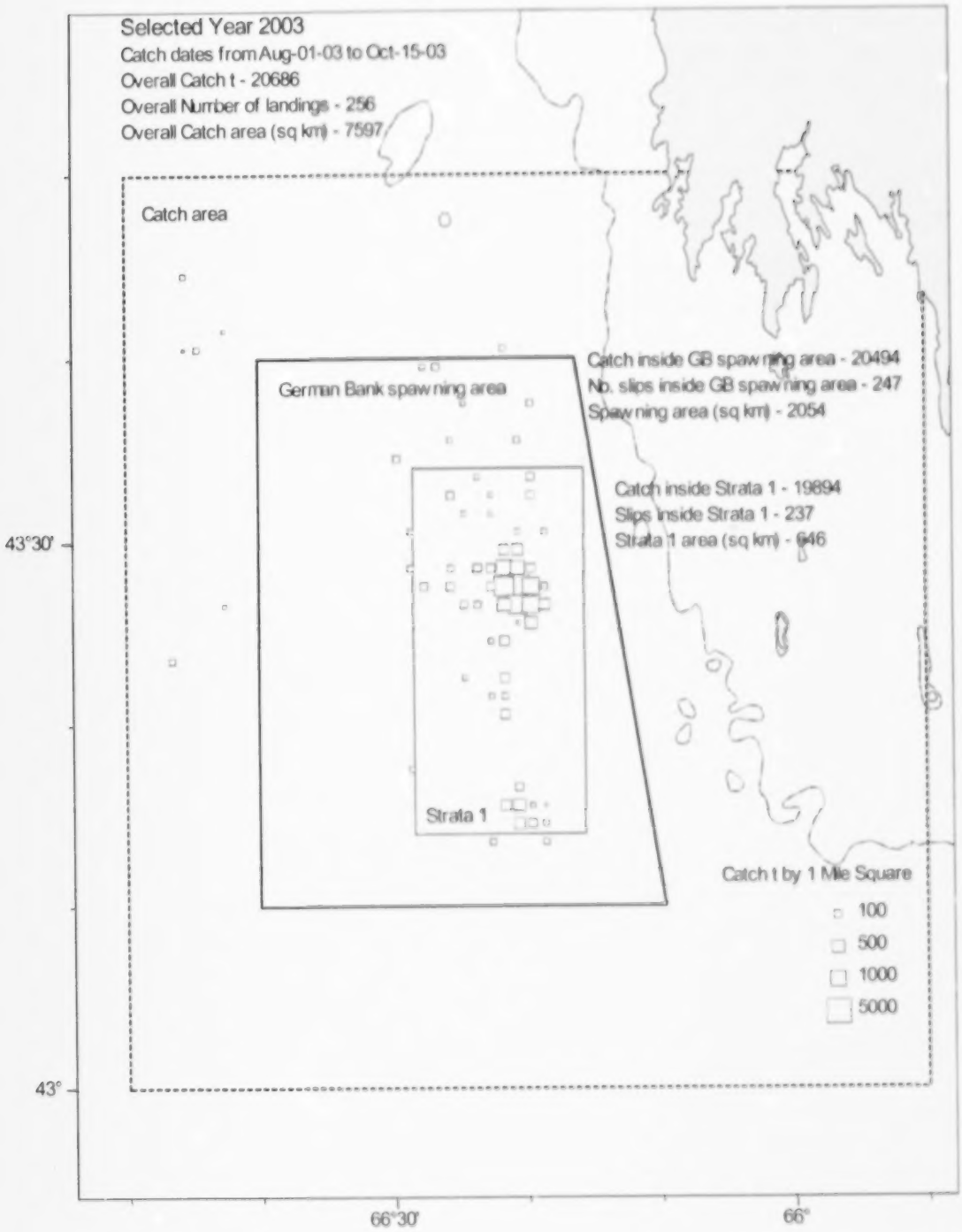


Figure 12. 2003 German Bank spawning fishery (catches t and area in km^2) for the spawning period Aug. 1 to Oct. 15, 2003 in the selected 'Catch Area', 'Spawning Area' and the primary acoustic survey areas (Strata 1) as defined.

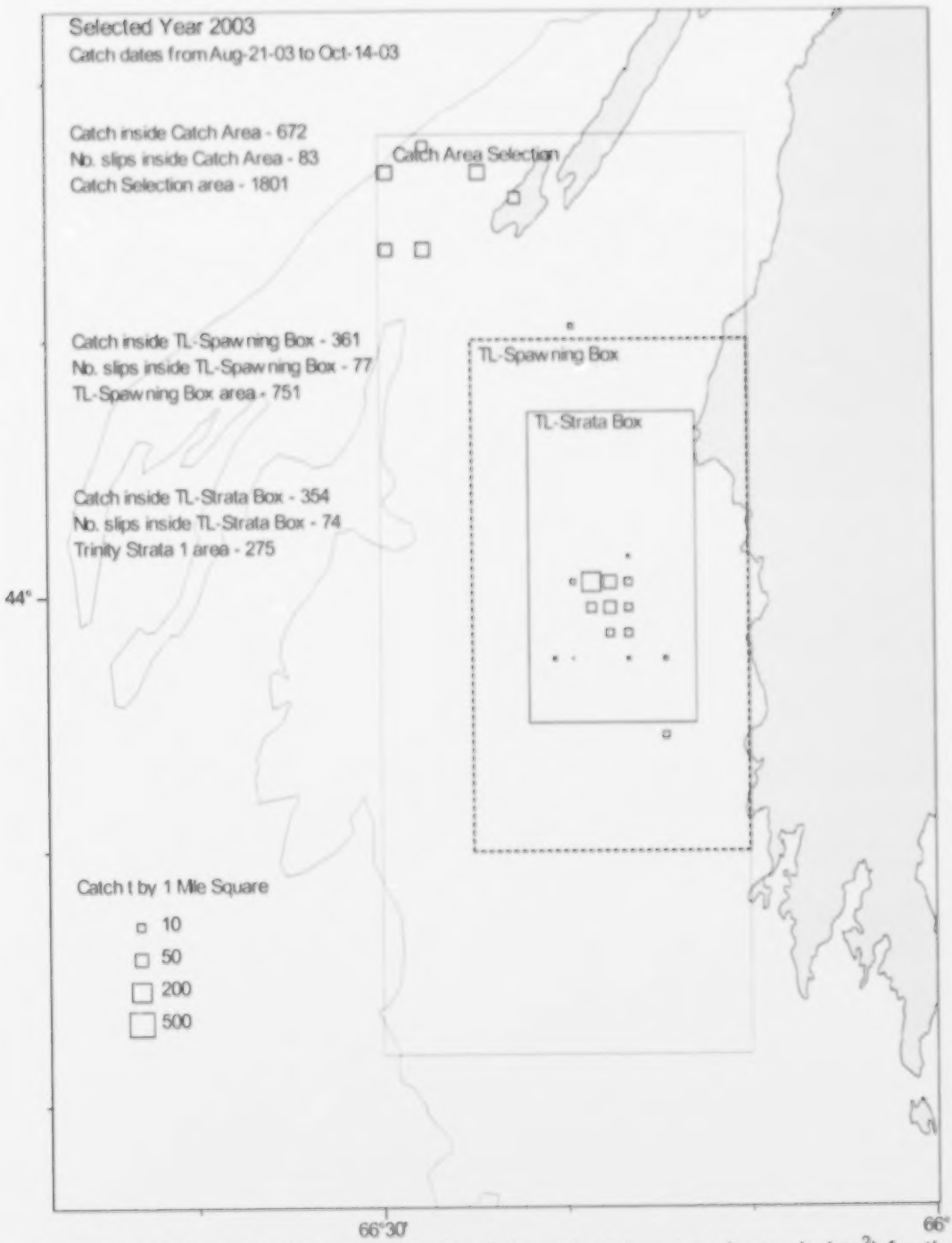


Figure 13. 2003 Trinity Ledge spawning fishery (catches t and area in km^2) for the spawning period Aug. 21 to Oct. 14, 2003 in the selected 'Catch Area', 'Spawning Box' and the primary acoustic survey area (Strata Box) as defined.

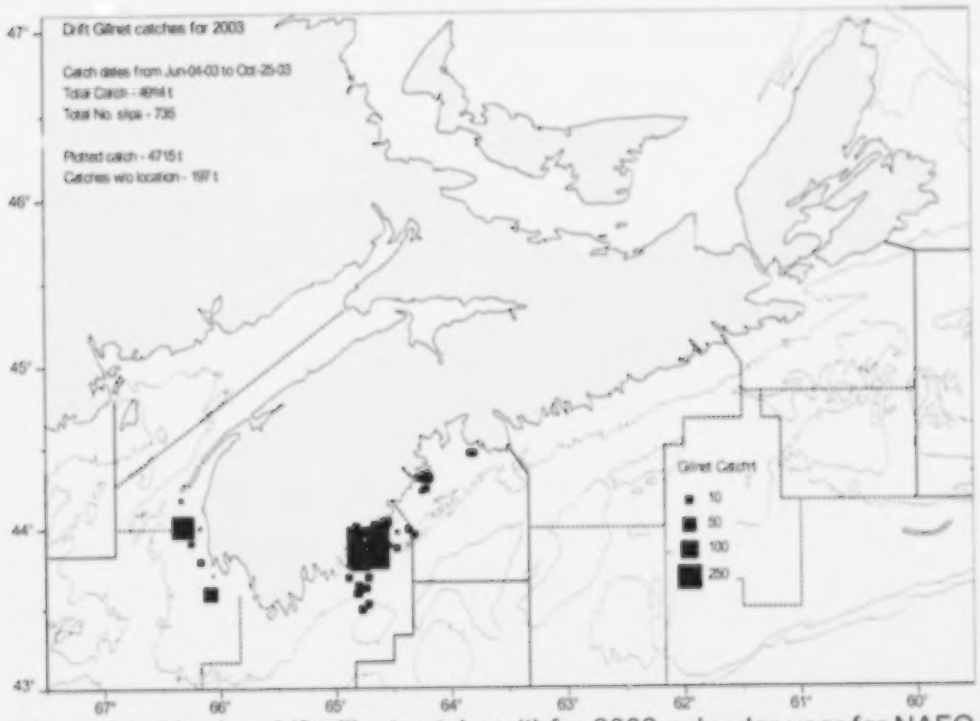


Figure 14. Herring drift gillnet catches (t) for 2003 calendar year for NAFO areas 4VWX (data from Statistics Division ZIF database).

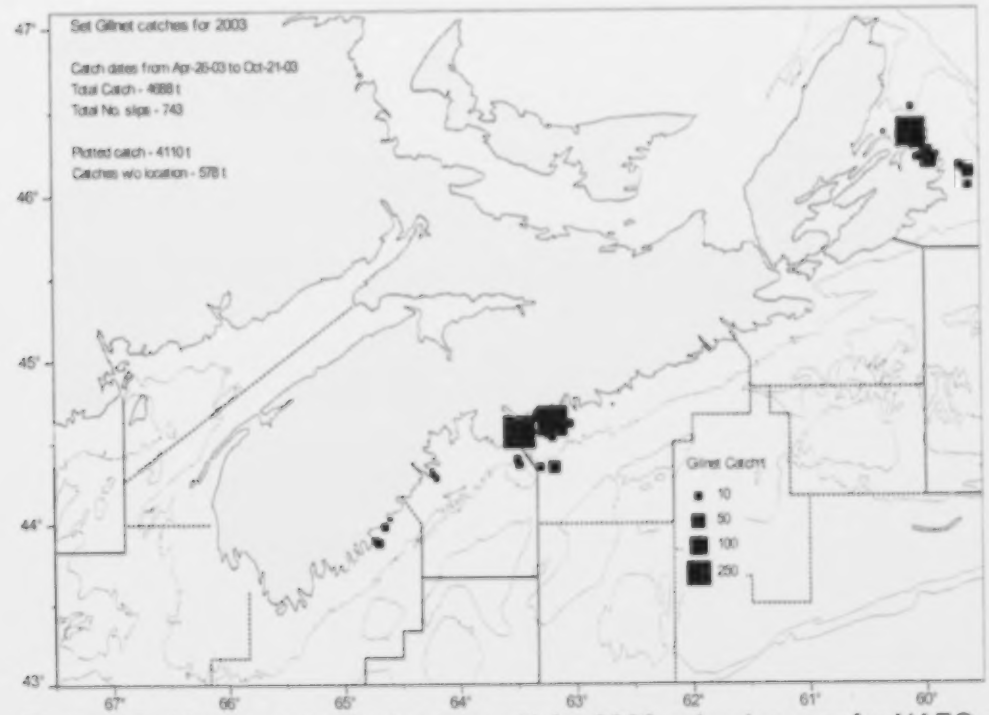


Figure 15. Herring set gillnet catches (t) for 2003 calendar year for NAFO areas 4VWX (data from Statistics Division ZIF database).

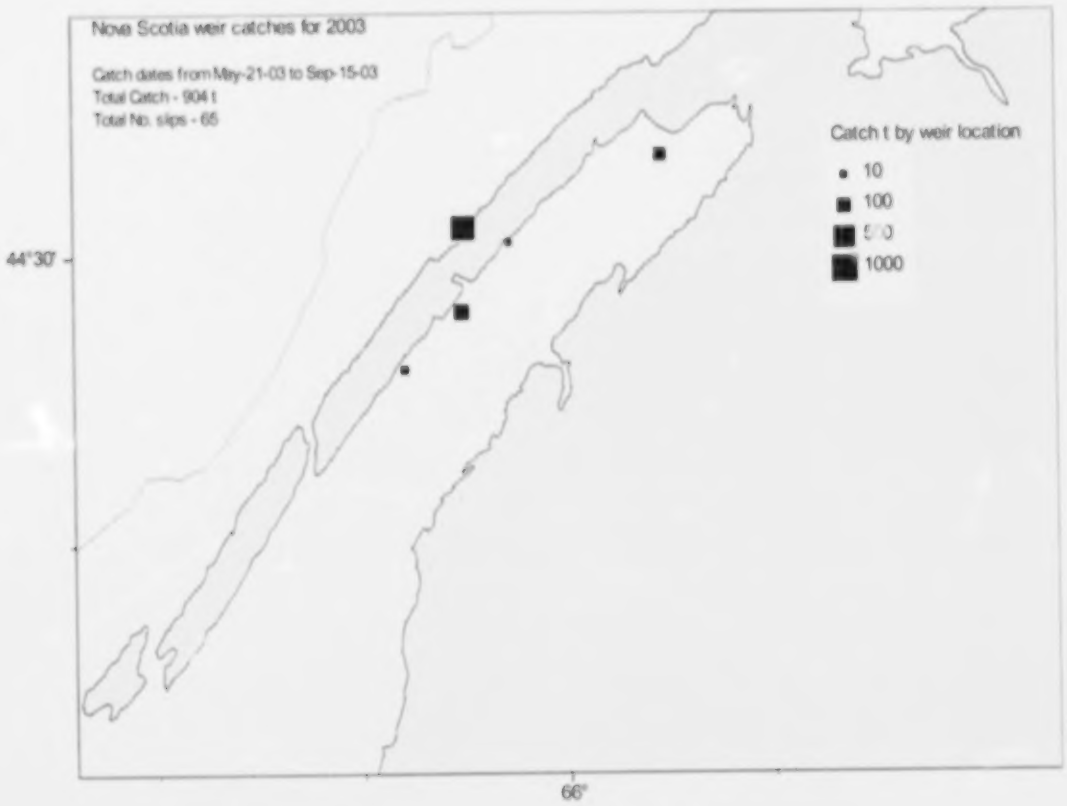


Figure 16. Nova Scotia herring weir catches for 2003 calendar year.

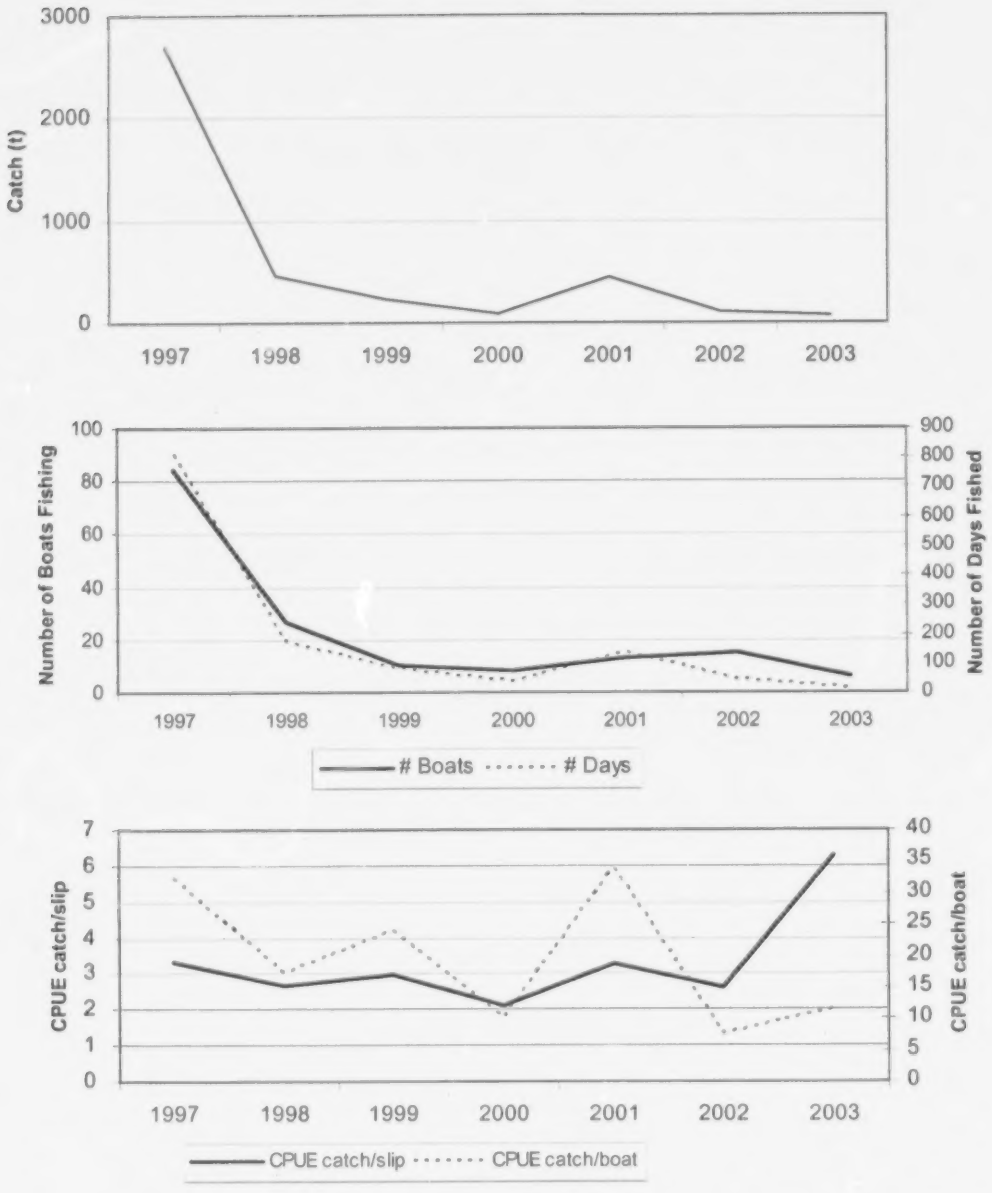


Figure 17. Herring gillnet catch (top panel), effort (middle panel) and CPUE (bottom) for the Spectacle Buoy area from landings in the month of June for statistical districts 31,32,33,34 and 36 (Barrington to St. Mary's Bay, N.S.)

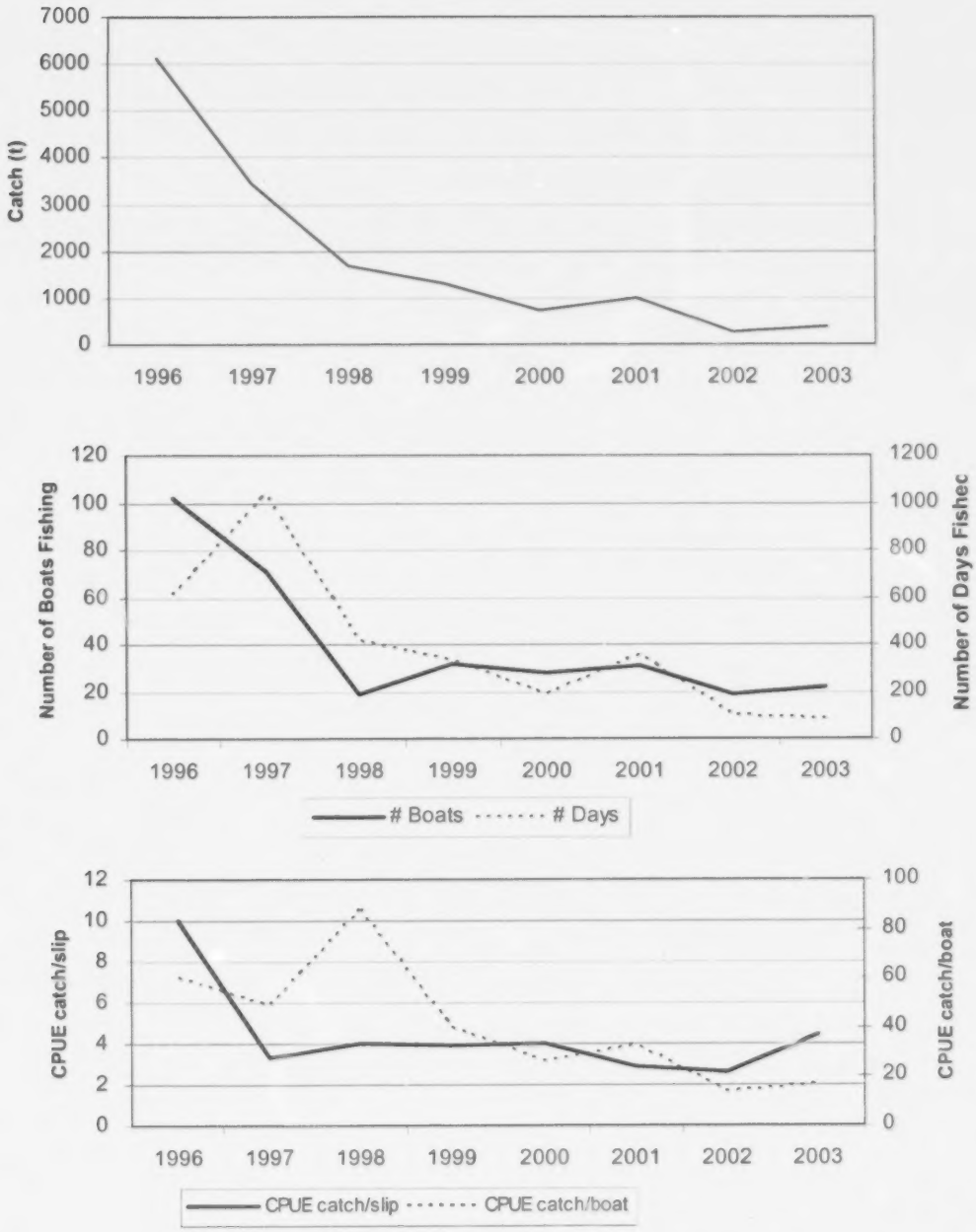


Figure 18. Herring gillnet catch (top panel), effort (middle panel) and CPUE (bottom) for Trinity Ledge area from landings in the months of August and Sept. for statistical districts 31,32,33,34 and 36 (Barrington to St. Mary's Bay, N.S.).

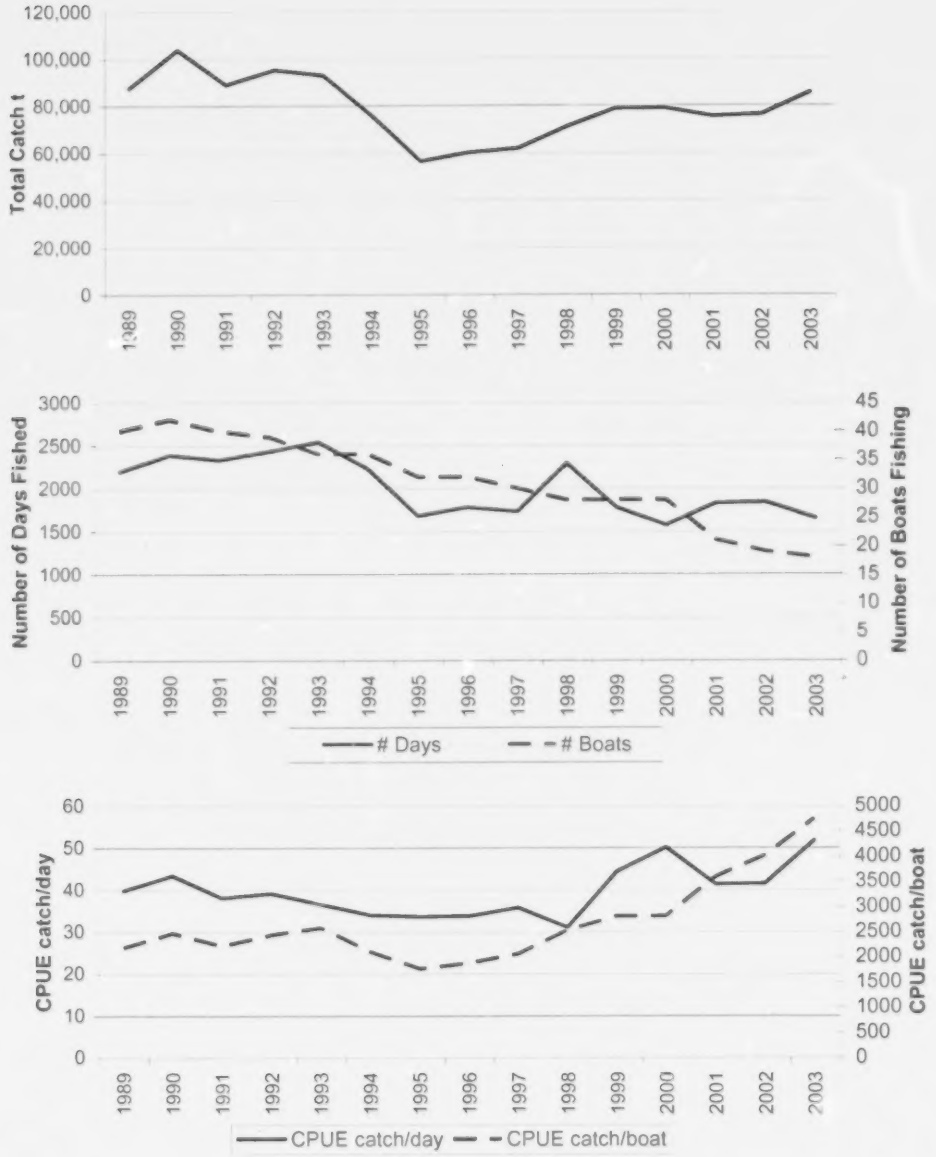


Figure 19. Purse seine catch (top panel), effort (middle panel) and CPUE (bottom) from 1989 to 2003 annual 4WX herring landings data for the SW Nova Scotia/Bay of Fundy spawning component.

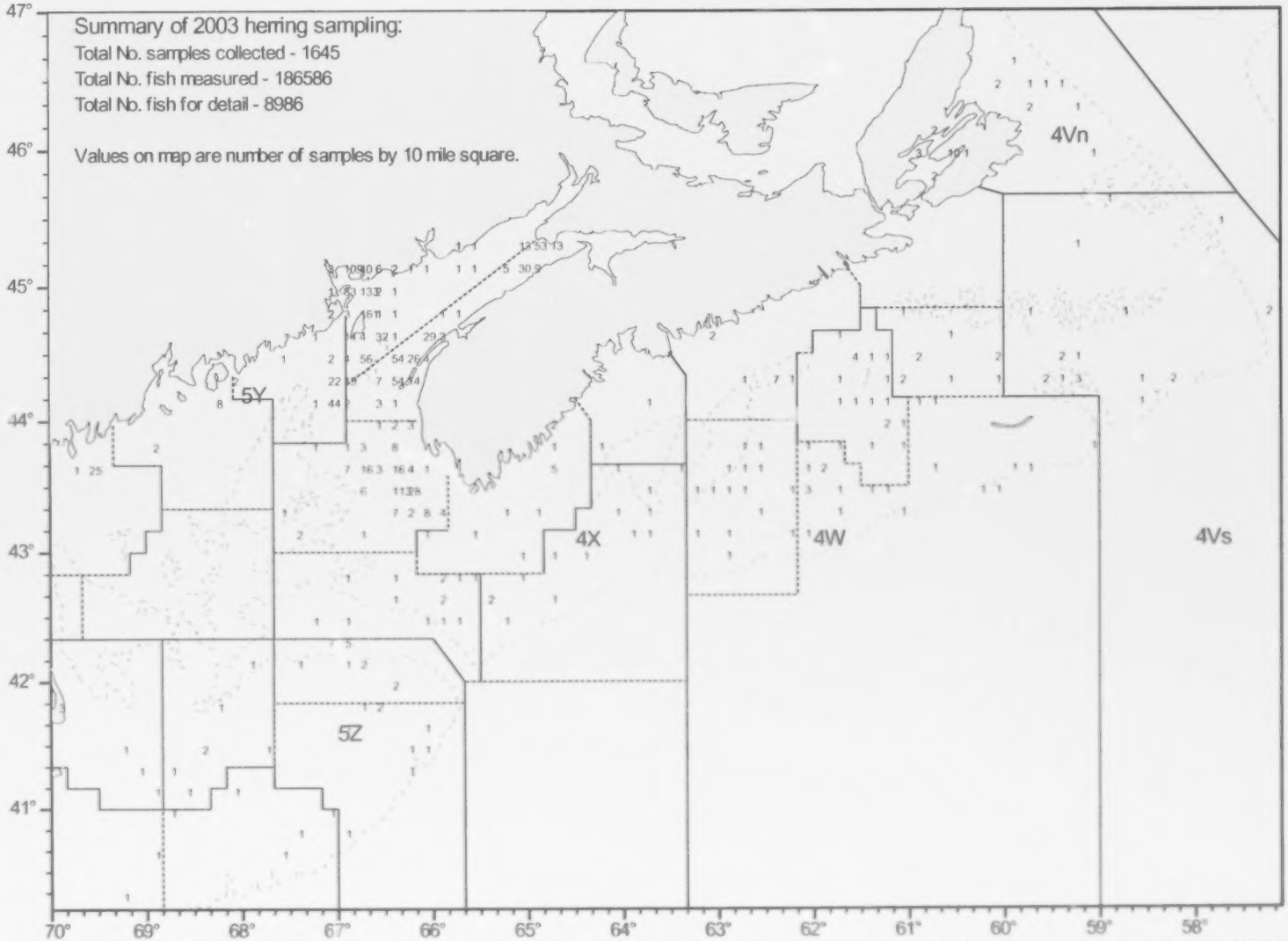


Figure 20. 2003 herring sampling coverage from all sources (number of length frequency samples by 10 mile square).

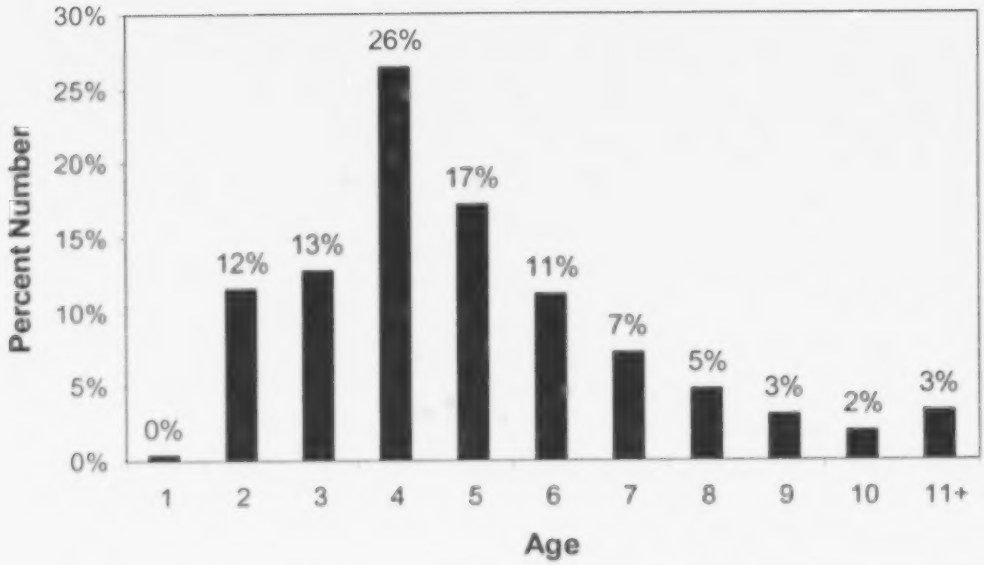


Figure 21. Expected age structure of SW Nova Scotia herring caught in the fishery with fishing at $F_{0.1}$ and constant average recruitment. Parameters: long-term F=0.23, annual recruitment=1.8 billion, natural mortality=0.2, partial recruitment vector=0.006, 0.235, 0.339 and 1.

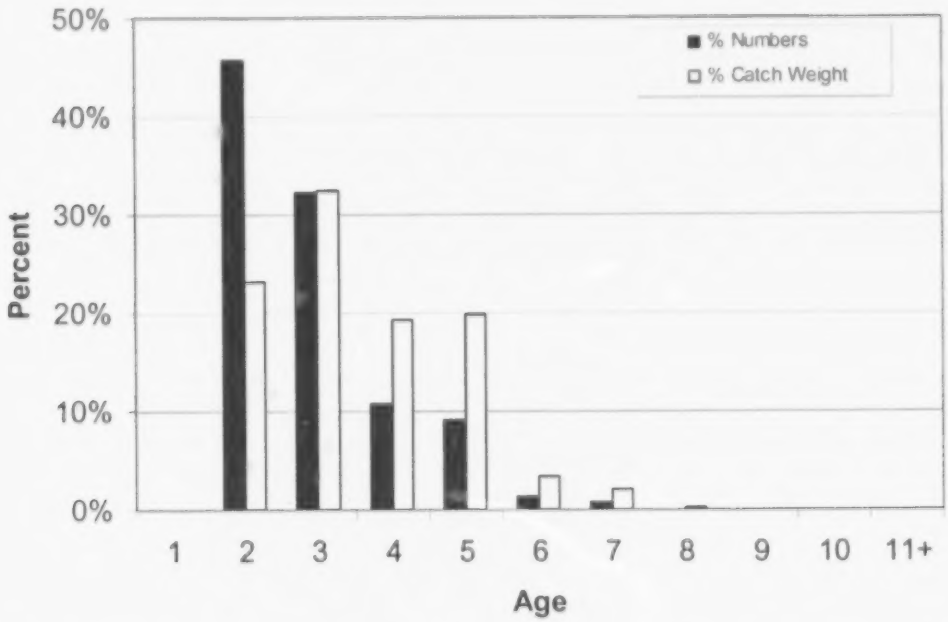


Figure 22. Catch at age for 2003 for the overall southwest Nova Scotia spawning component (% numbers and % weight).

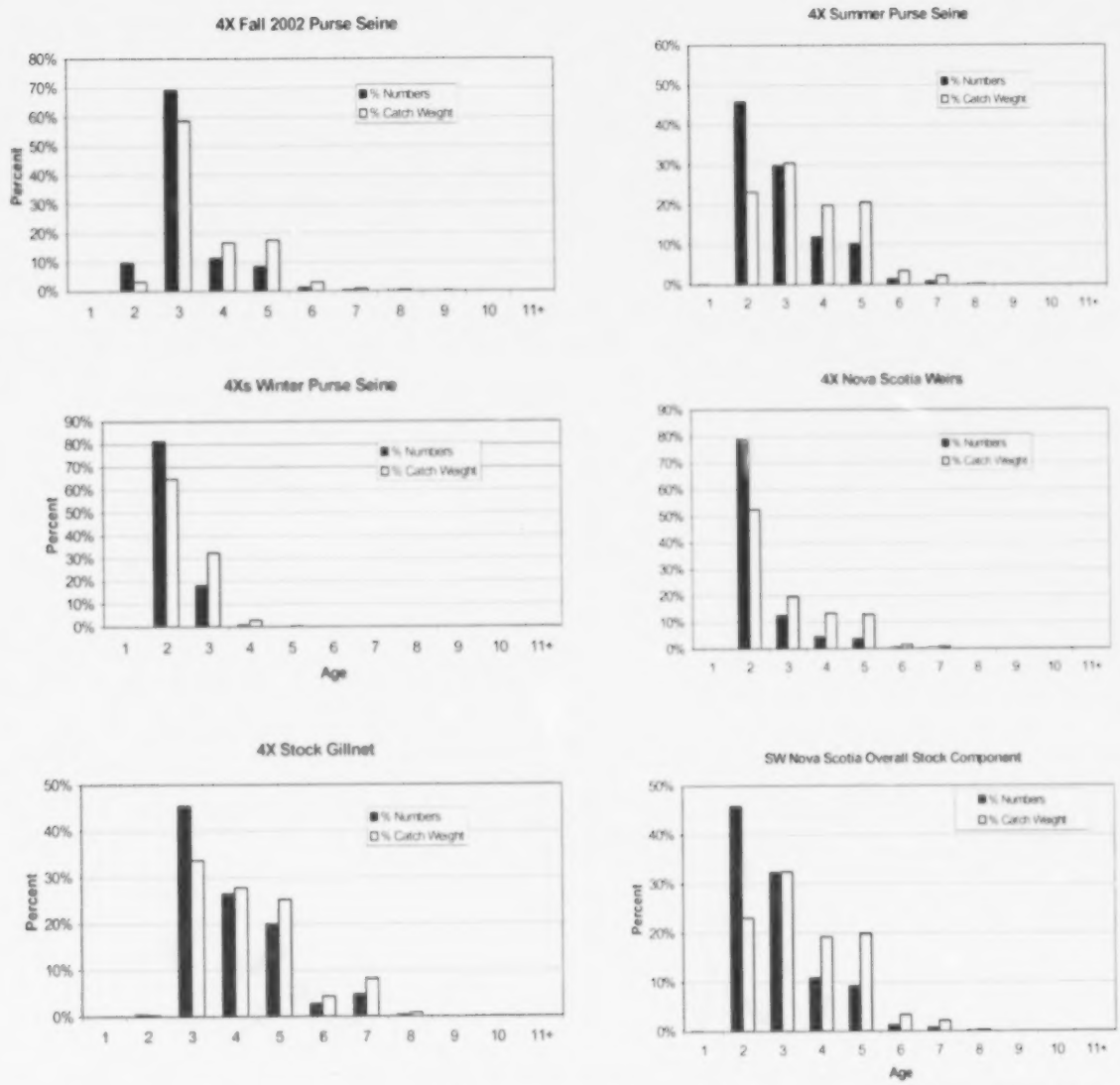


Figure 23. Catch at age for the 2003 southwest Nova Scotia spawning component (% numbers and % weight) by gear type.

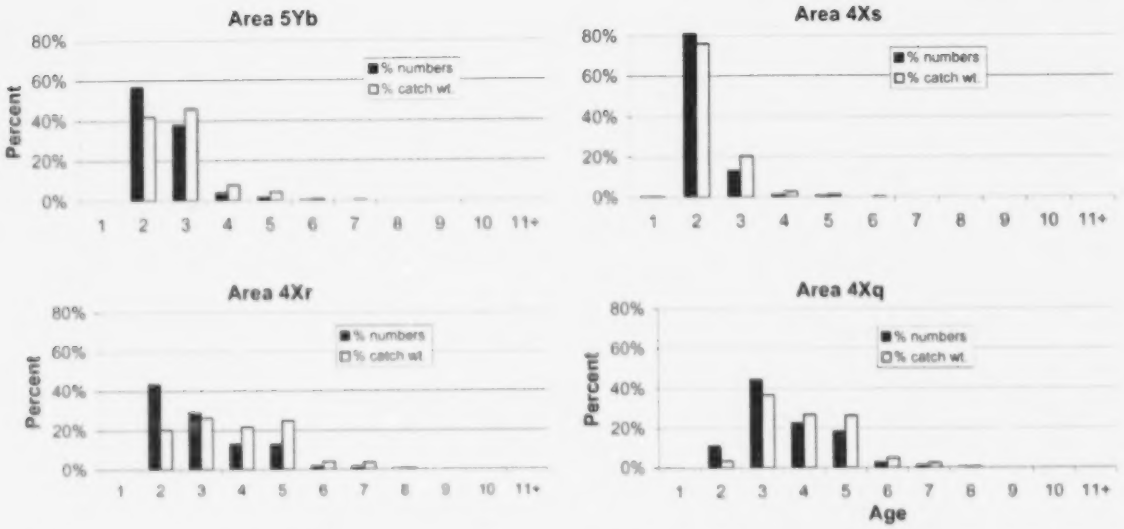


Figure 24. Herring catch at age by NAFO unit area for the 2003 summer purse seine fishery conducted on the southwest Nova Scotia spawning component (4WX stock).

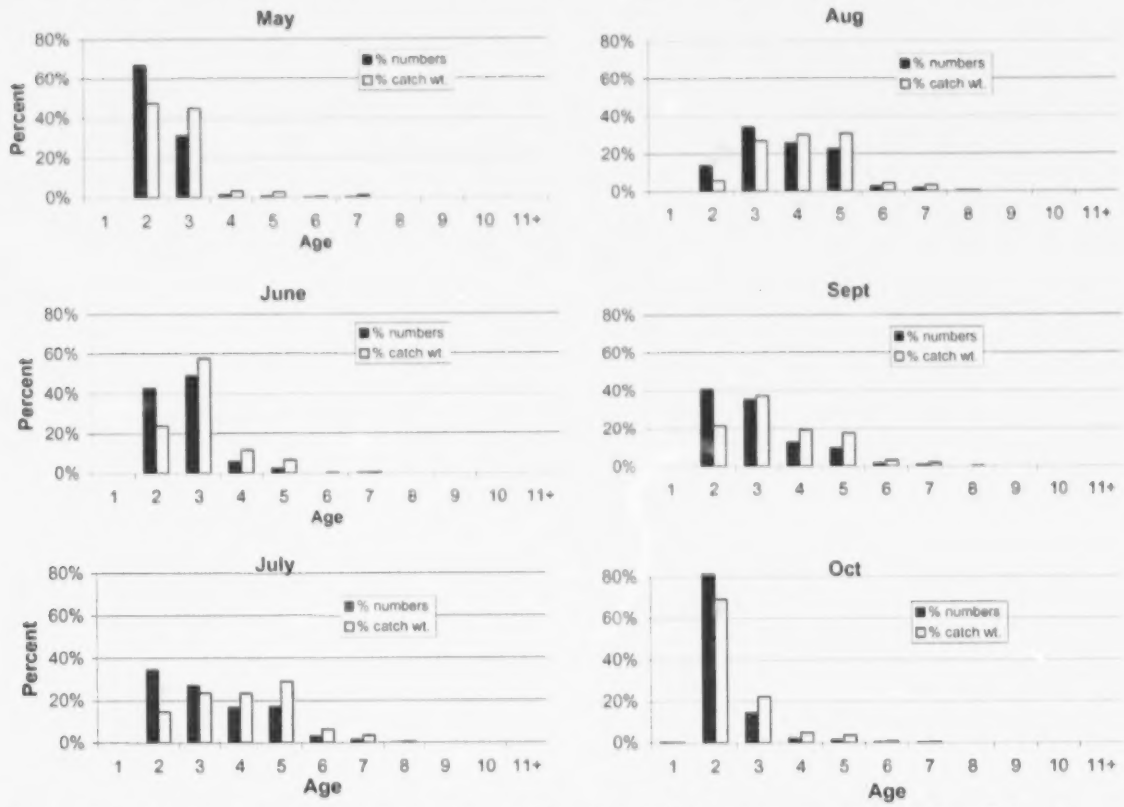


Figure 25. Herring catch at age by month for the 2003 summer purse seine fishery conducted on the southwest Nova Scotia spawning component (4WX stock).

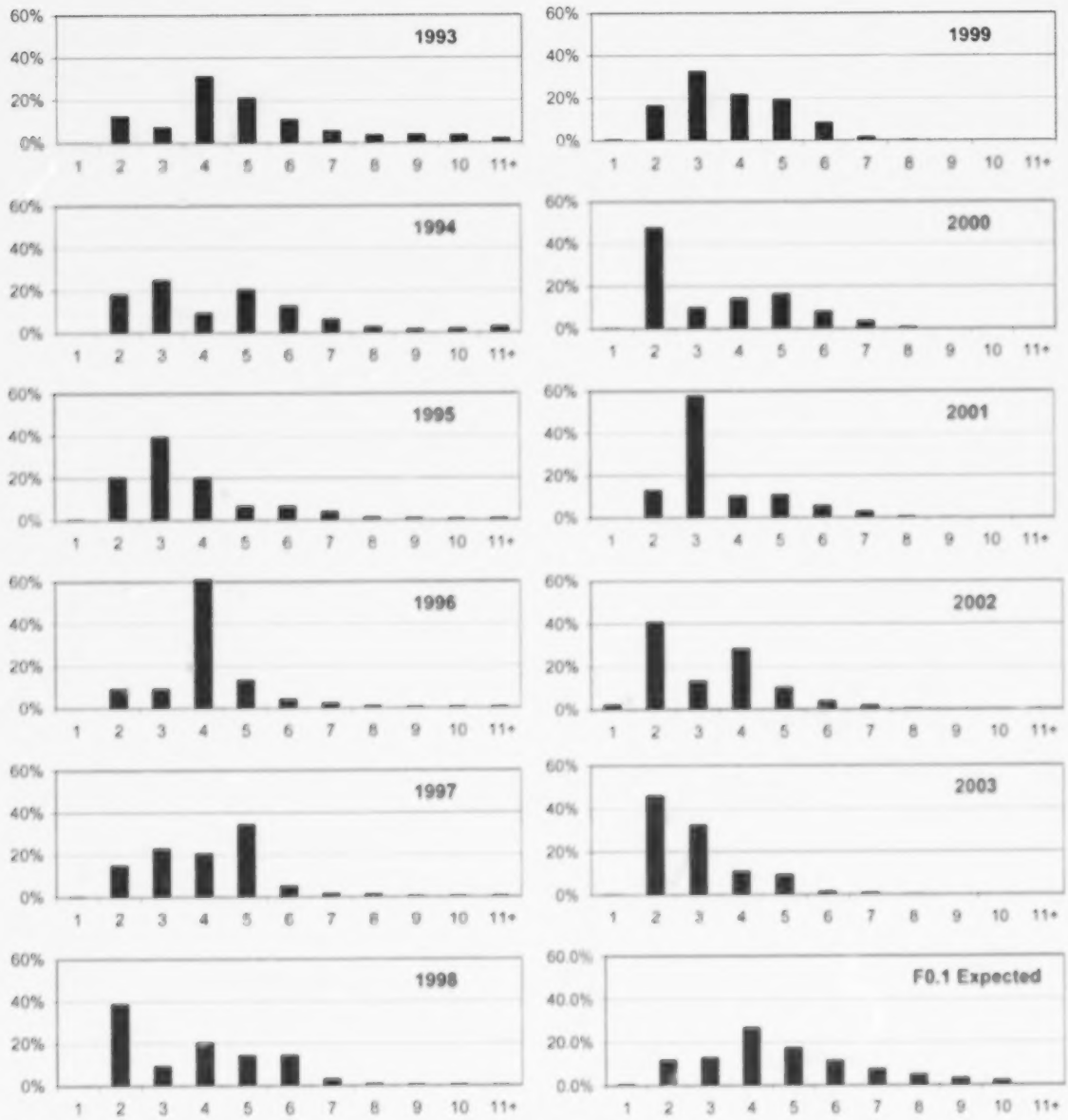


Figure 26. Catch at age (% numbers) for the southwest Nova Scotia spawning component (4WX stock) from 1993 to 2003.

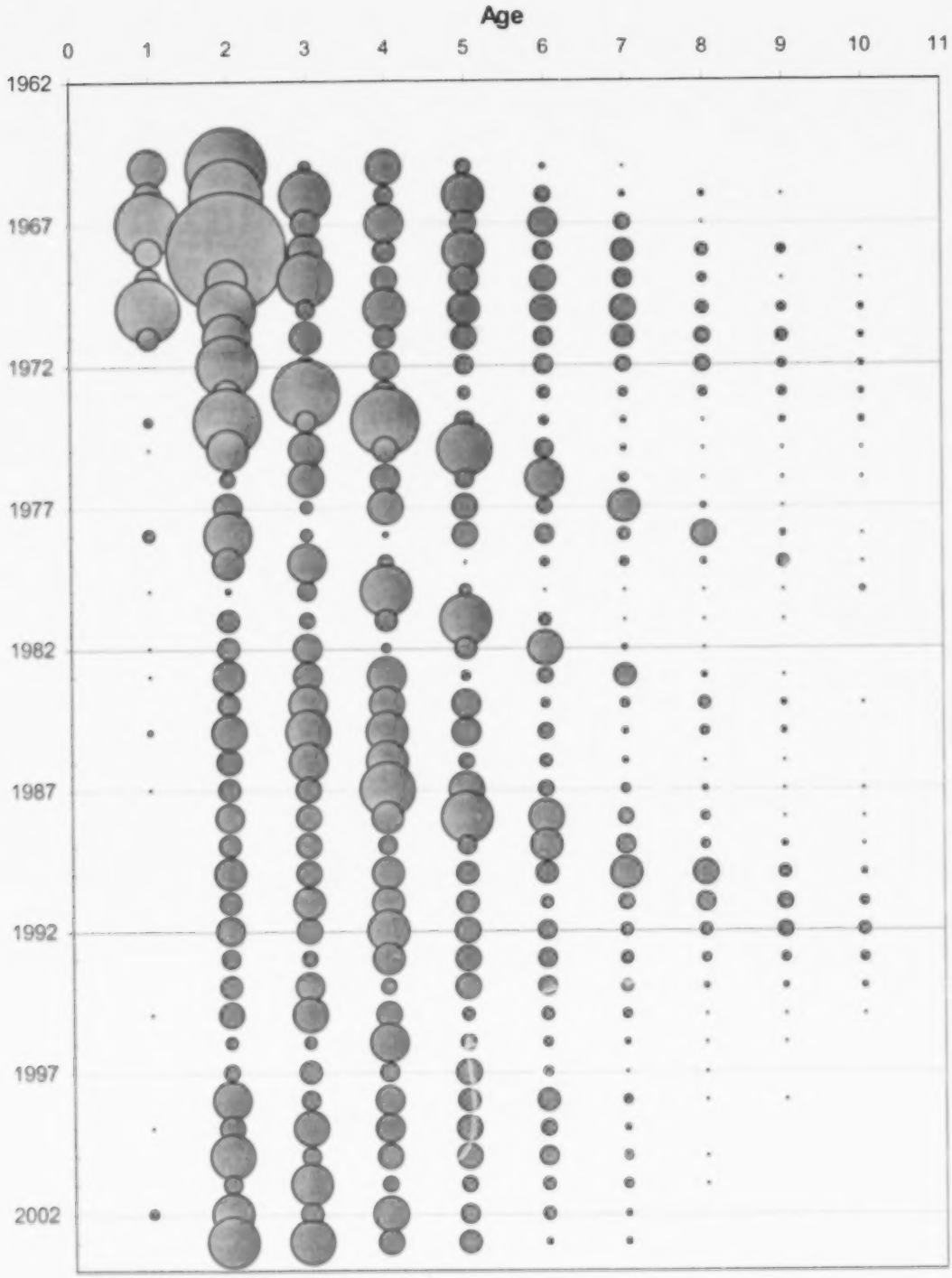


Figure 27. Historical catch at age (numbers) for the SW Nova Scotia spawning component. Refer to Table 14 for actual numbers represented by symbol size. The value for 1968 at age 2 represents the maximum in the series of 2,389 million.

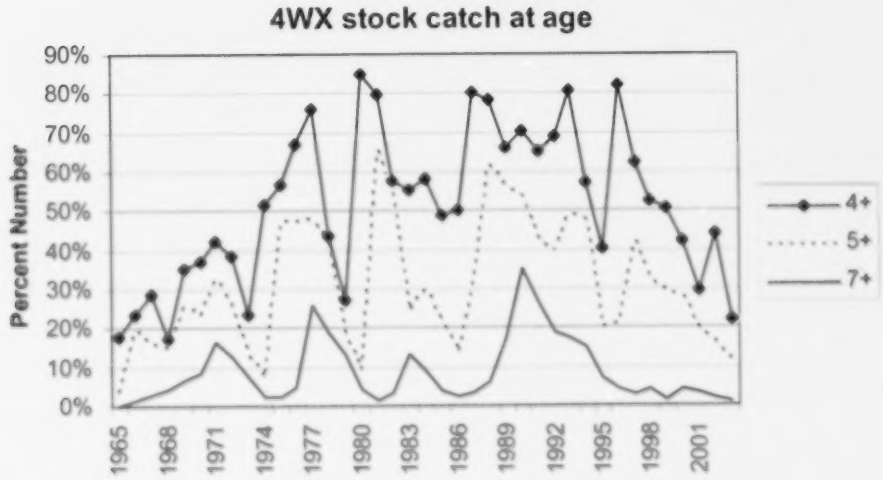


Figure 28. Overall proportions (percent numbers) of ages 4+, 5+ and 7+ in the catch at age for the SW Nova Scotia spawning component for the period 1965 to 2003.

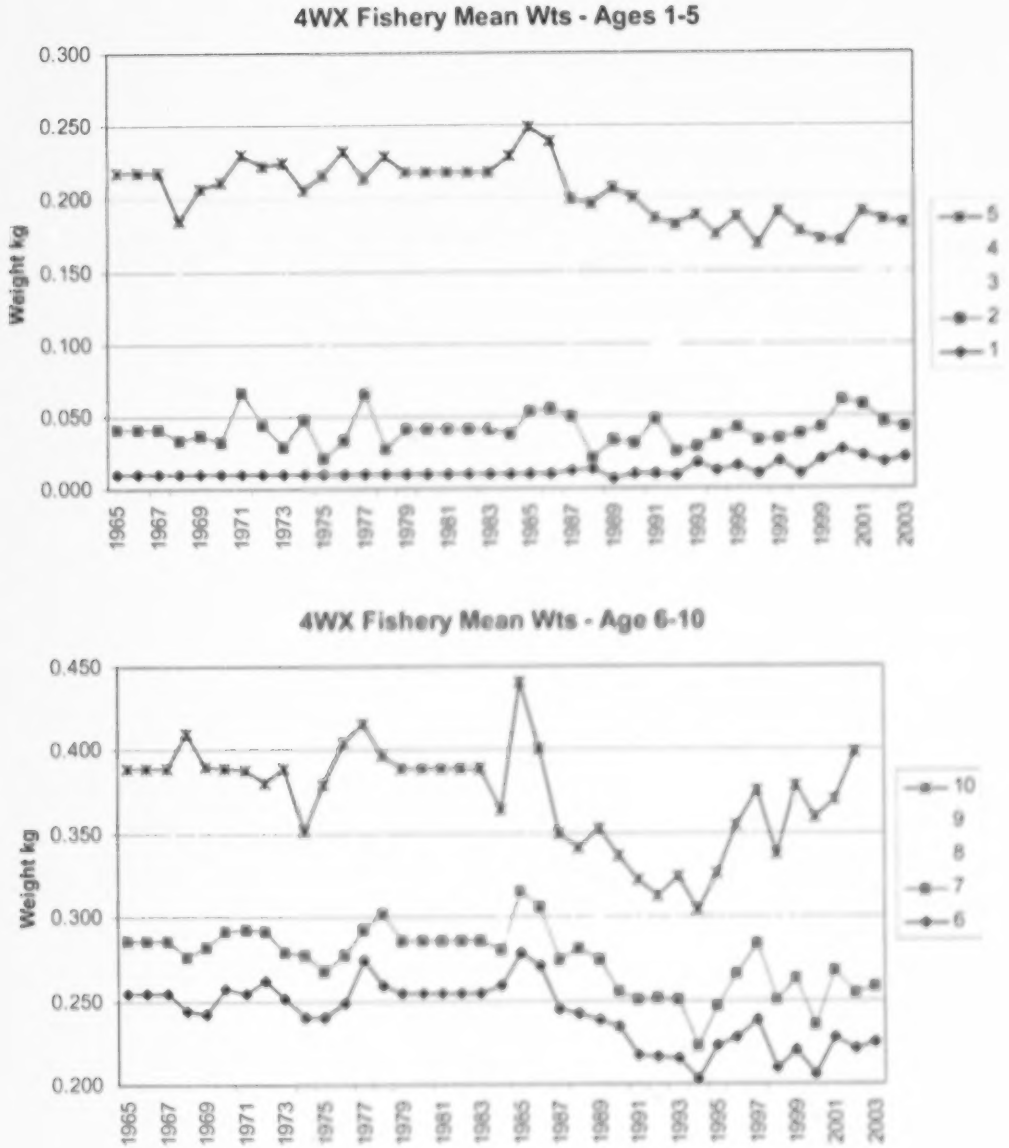
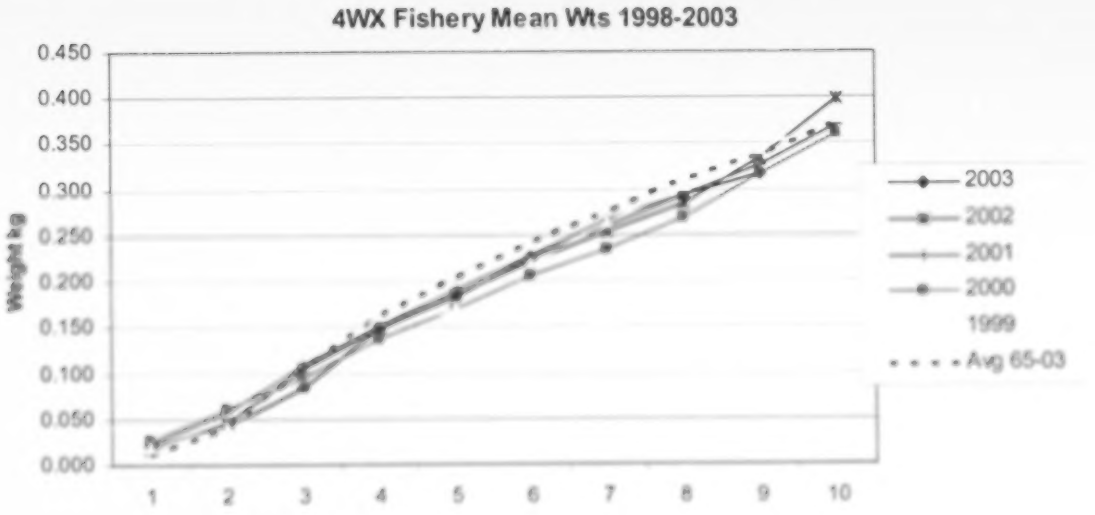


Figure 29. Average weights at age (g) for the SW Nova Scotia component of the 4WX herring fishery (weighted by fishery) for 1965-2003.



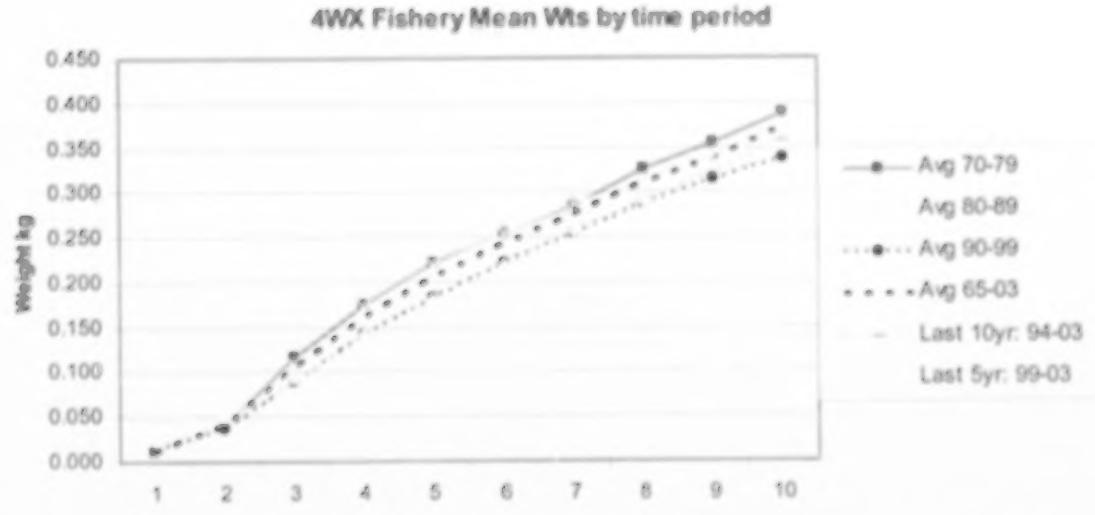


Figure 30. Average weights at age (g) for the SW Nova Scotia component of the 4WX herring fishery (weighted by fishery) for a) most recent 5 years individually (top panel) and b) for 10 year time periods since 1970 as well as the most recent 5 and 10 year periods combined.

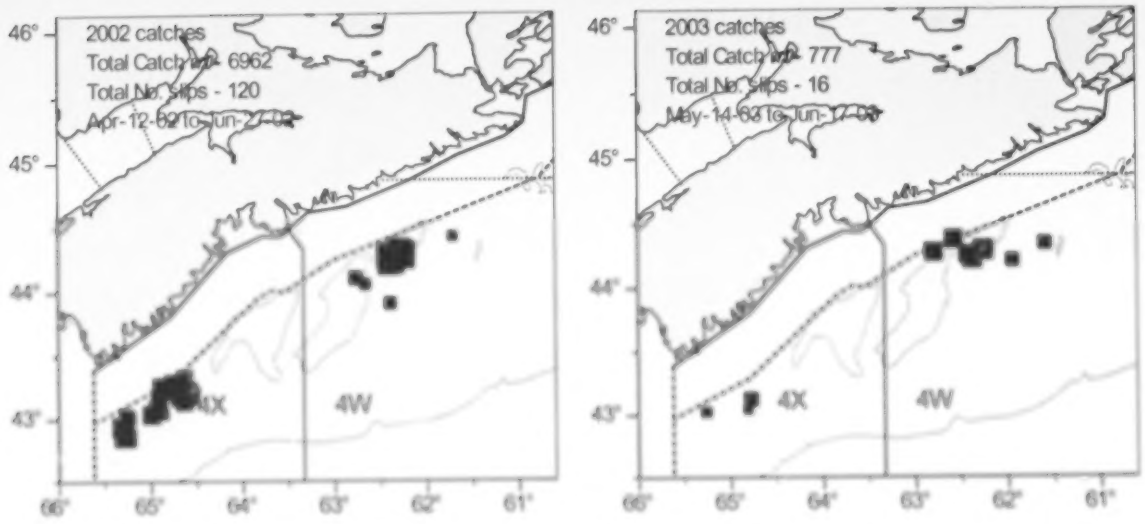


Figure 31. Herring purse seine catches on the offshore Scotian Shelf banks for 2002 and 2003 with embayment and offshore 25 mile lines shown.

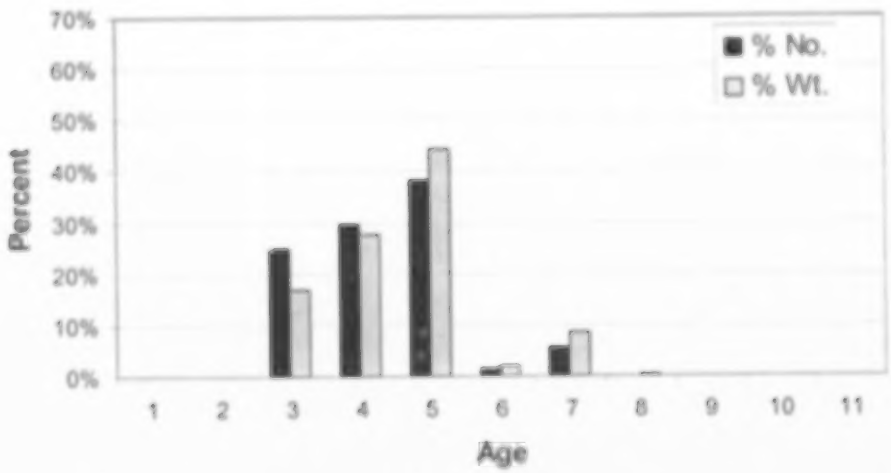


Figure 32. Catch at age for 2003 for the offshore Scotian Shelf banks purse seine fishery (% numbers and % weight).

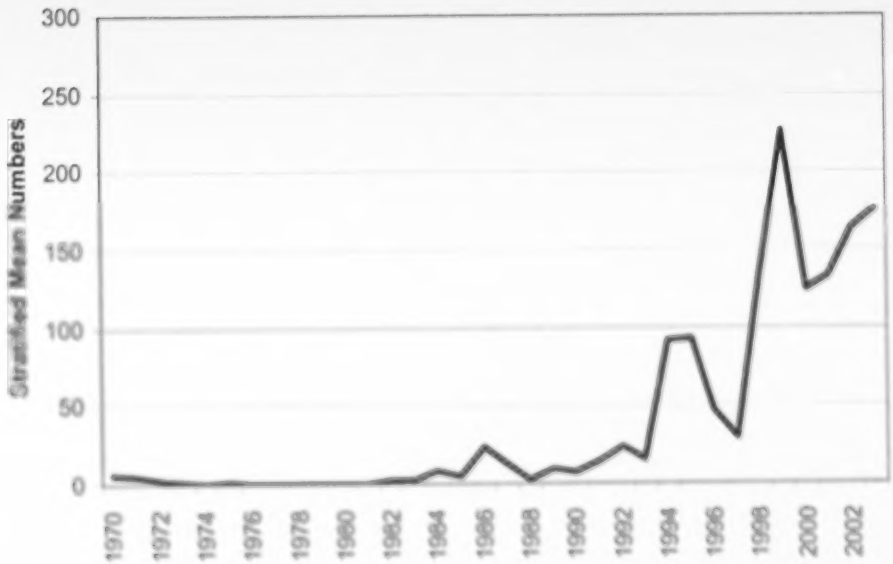


Figure 33. Number of herring caught per standard tow in the July bottom trawl survey of the offshore Scotian Shelf Banks, 1983 to 2003 (strata 55-78; from Sable Island to Baccaro Line).

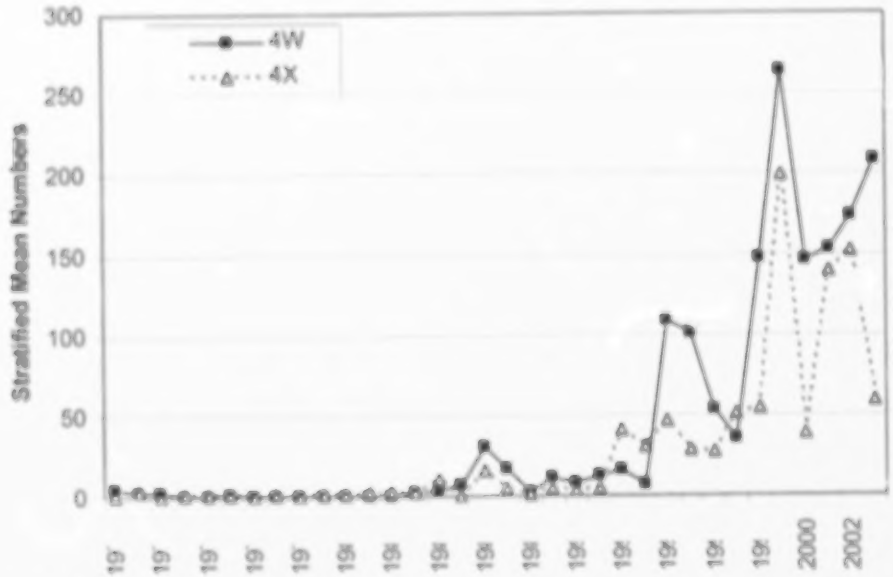


Figure 34. Number of herring caught per standard tow in the July bottom trawl survey of the offshore Scotian Shelf Banks, 1970 to 2003 for area 4W (strata 53-66) and area 4X (strata 70-95).

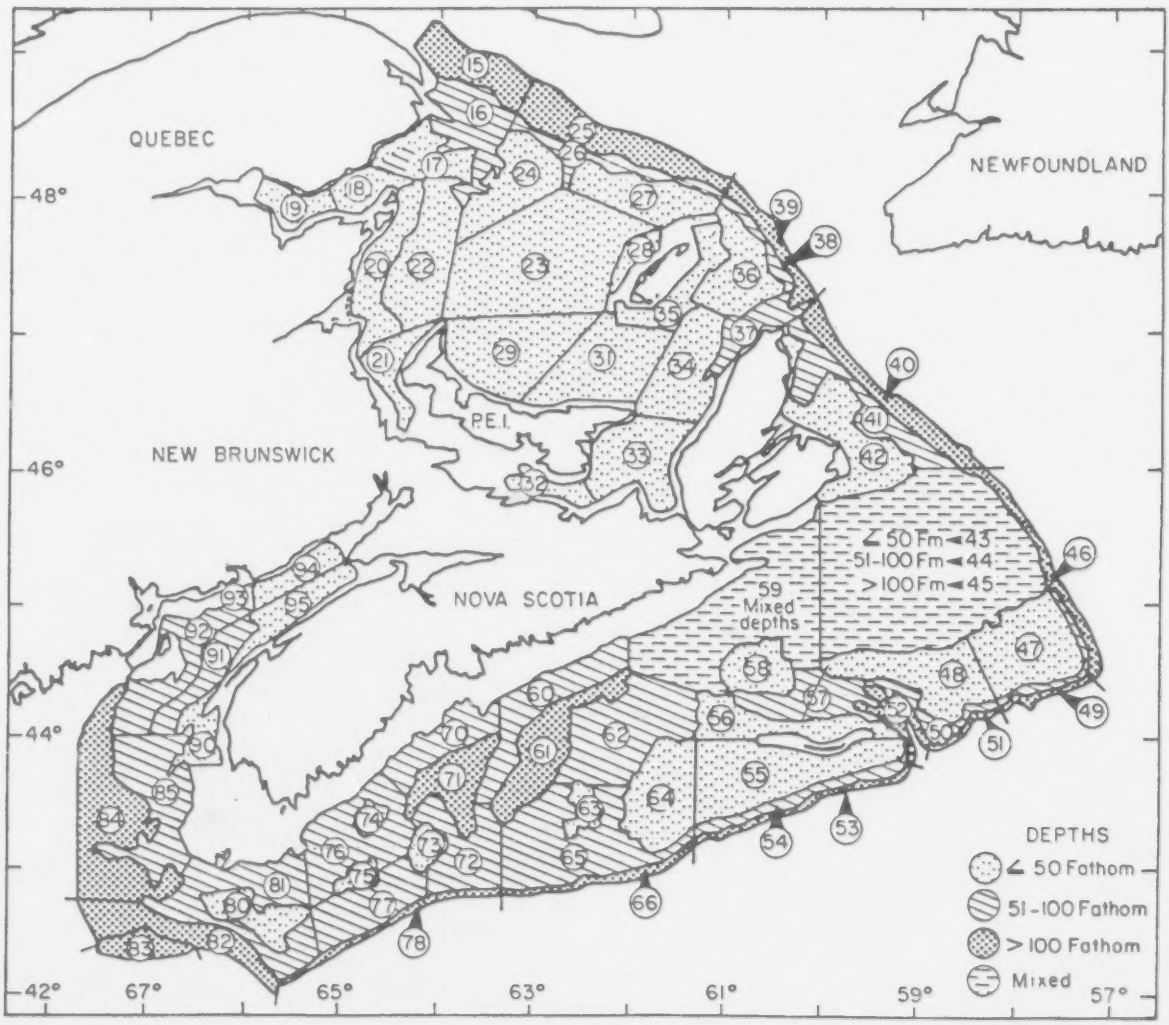


Figure 35. Groundfish survey strata in NAFO Divisions 4T, 4V, 4W and 4X (from Doubleday, 1981).

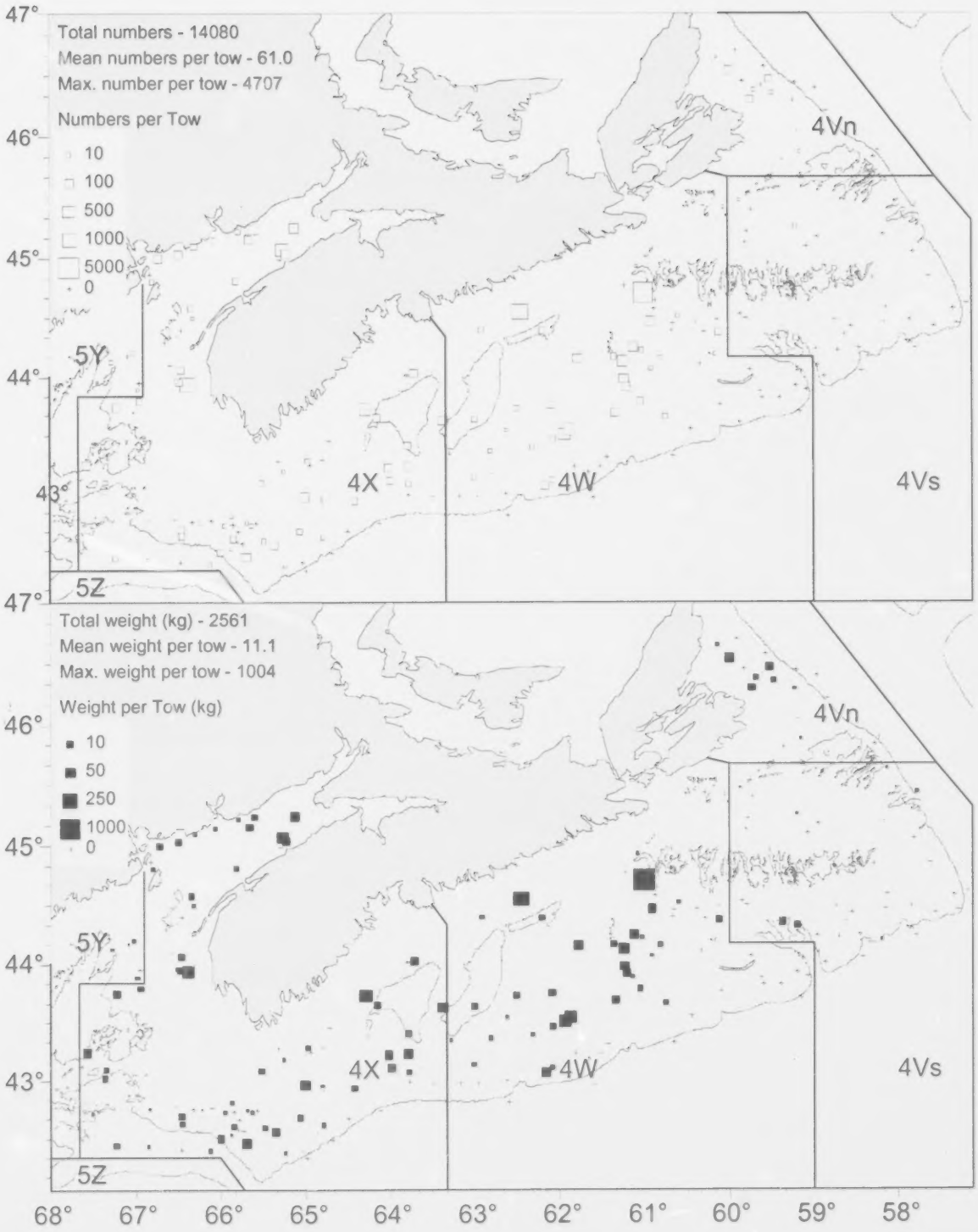


Figure 36. Herring catches in number and weight per tow for the 2003 4VWX summer bottom trawl survey (NED2003-036/042: July 2-31, 2003).

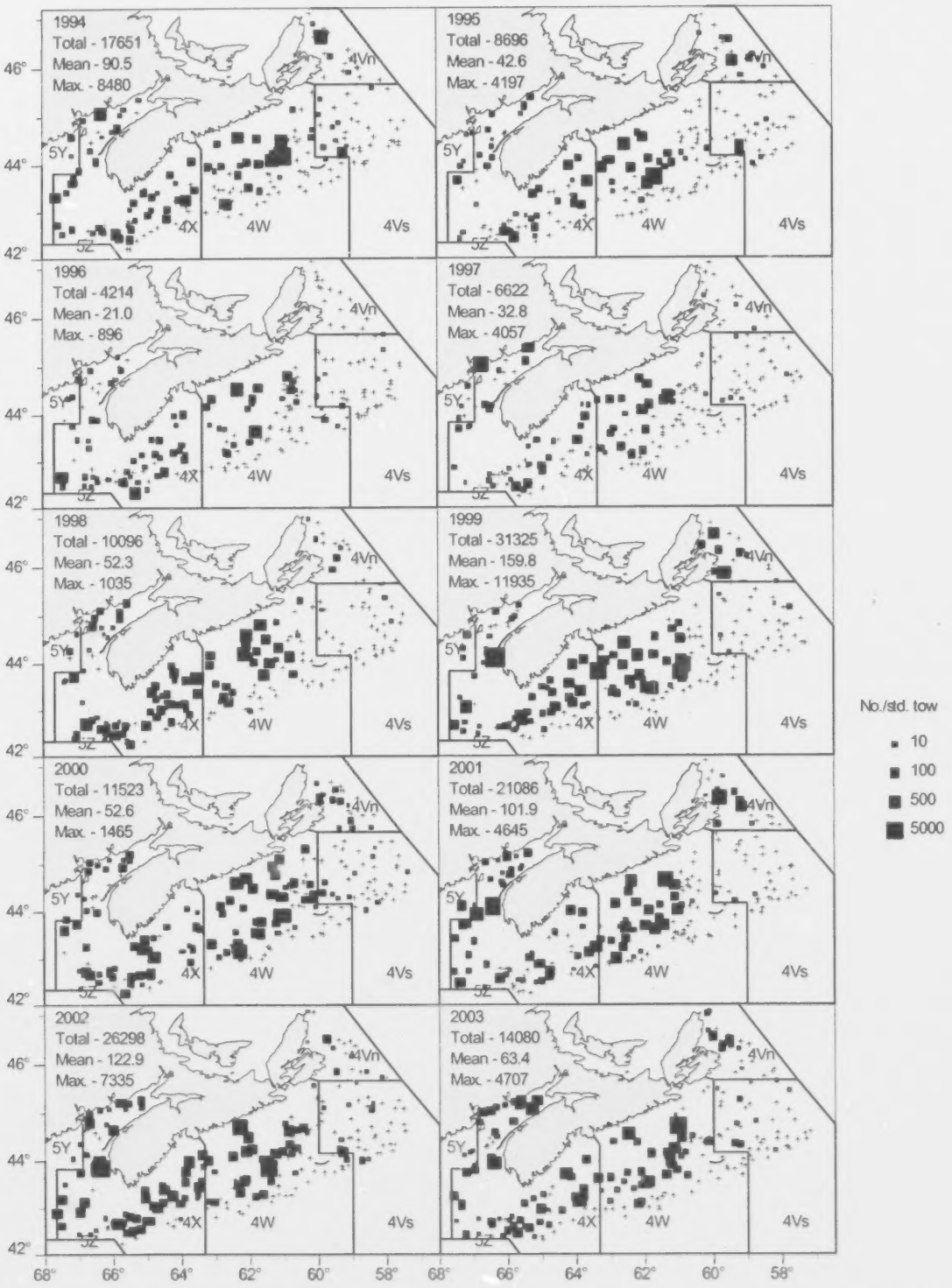


Figure 37. Herring catches (numbers per standard tow) from the July bottom trawl survey for 1994-2003.

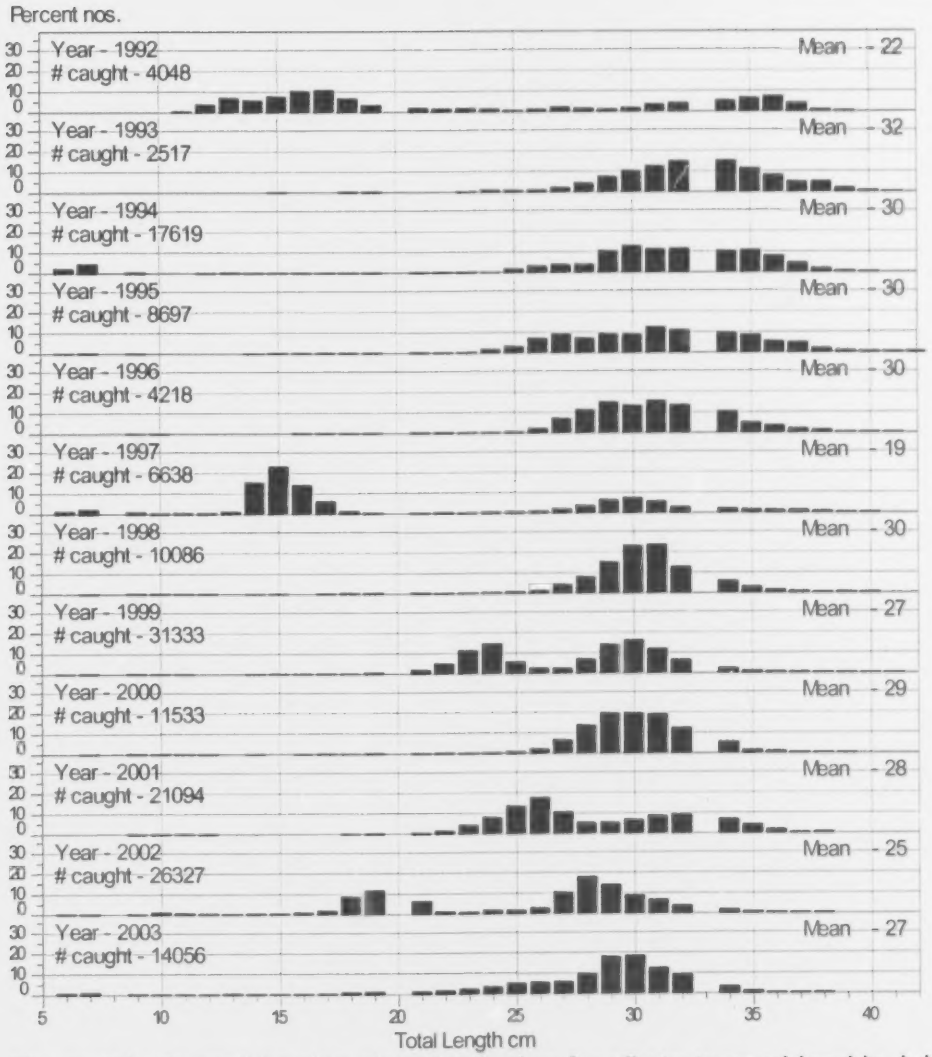


Figure 38. Overall herring size distribution for all strata combined in July 4VWX bottom trawl surveys from 1992 to 2003 (sizes converted from fork length to total length).

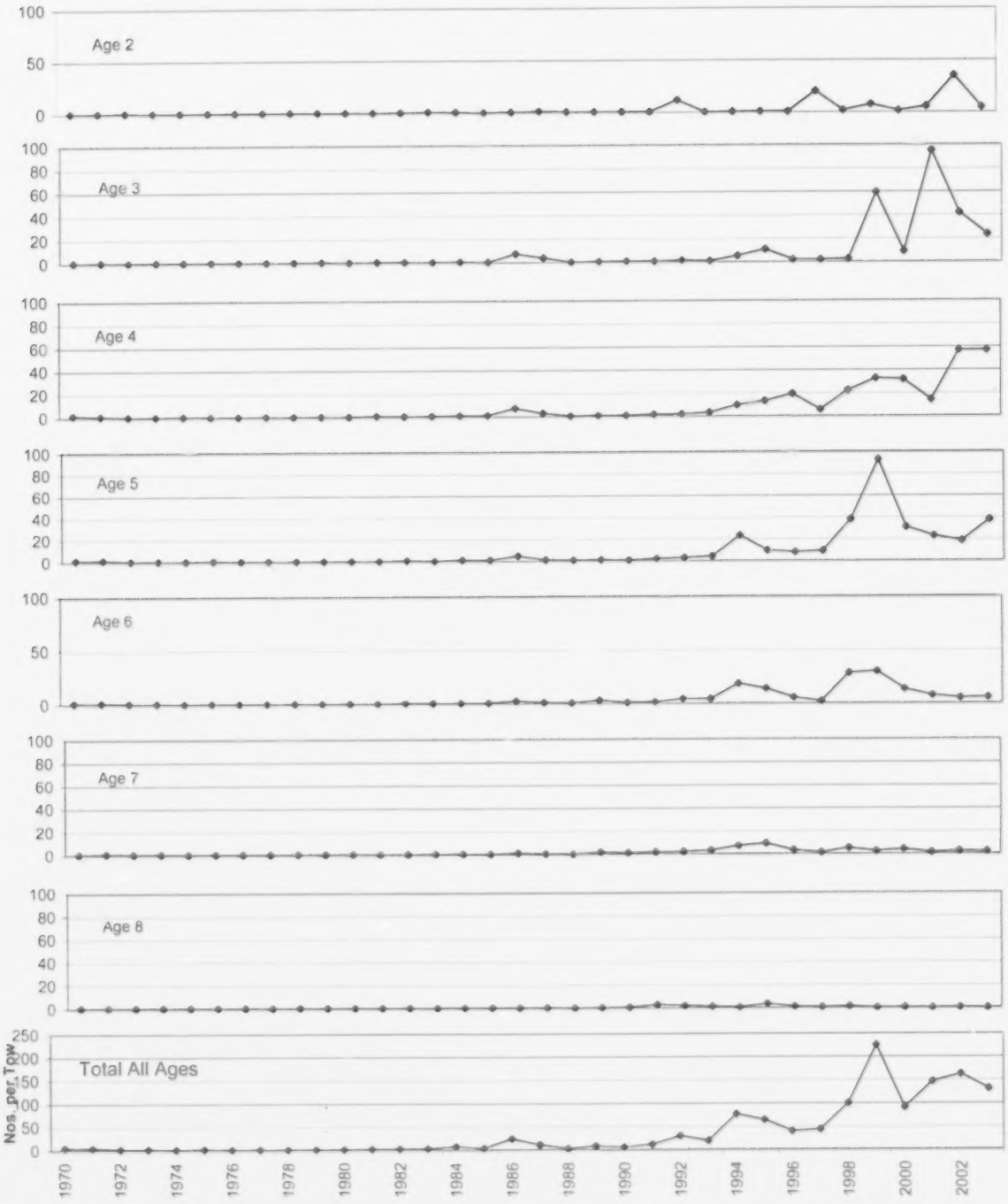


Figure 39. Stratified herring abundance by age and overall for all ages combined (numbers per tow) from the July ground trawl survey for area 4WX (strata 53 to 95).

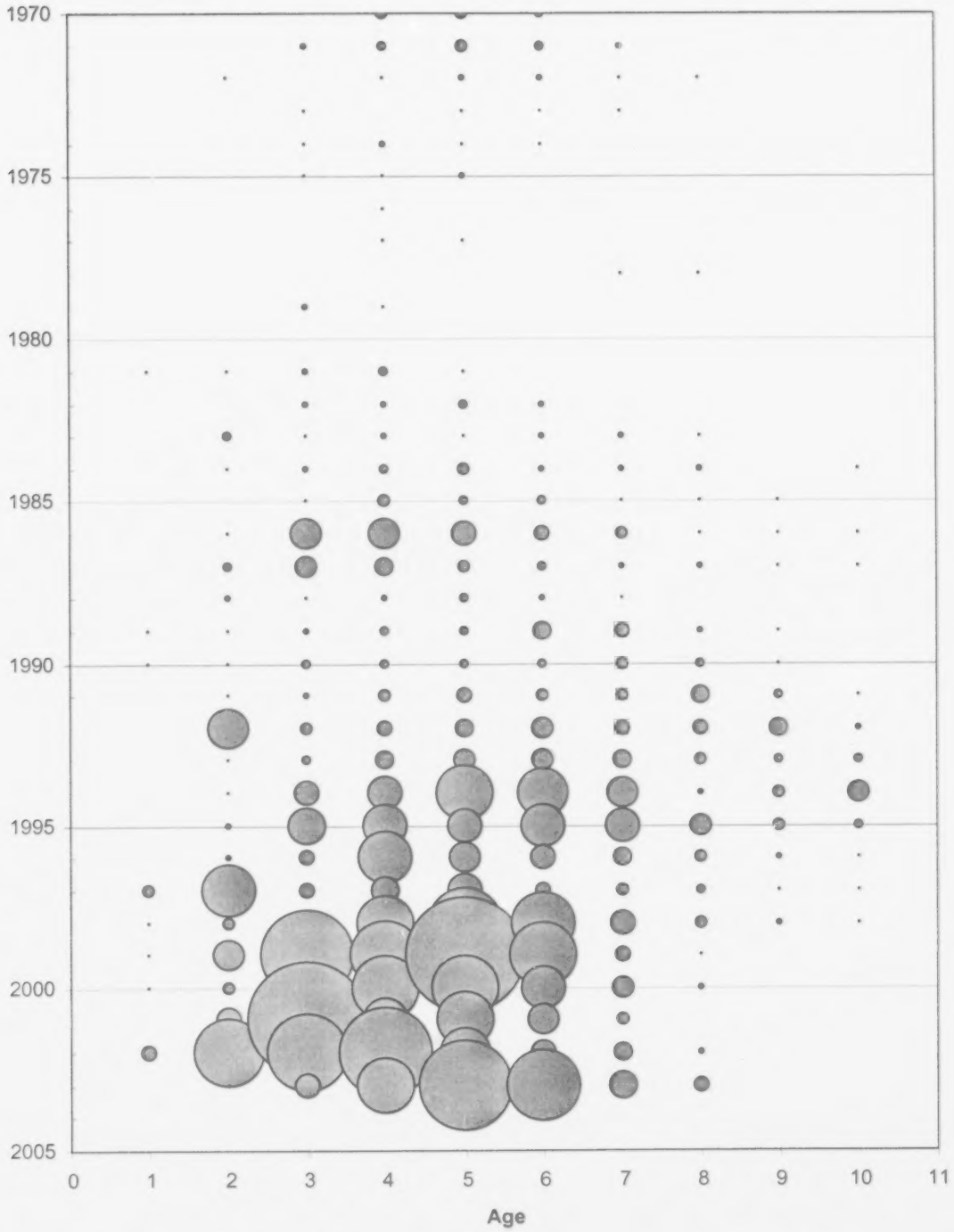


Figure 40. Stratified herring abundance by age from 1970 to 2003 (stratified numbers per tow) from the July ground trawl survey for area 4WX (strata 53 to 95). Refer to Table 26 for values represented by symbol size.

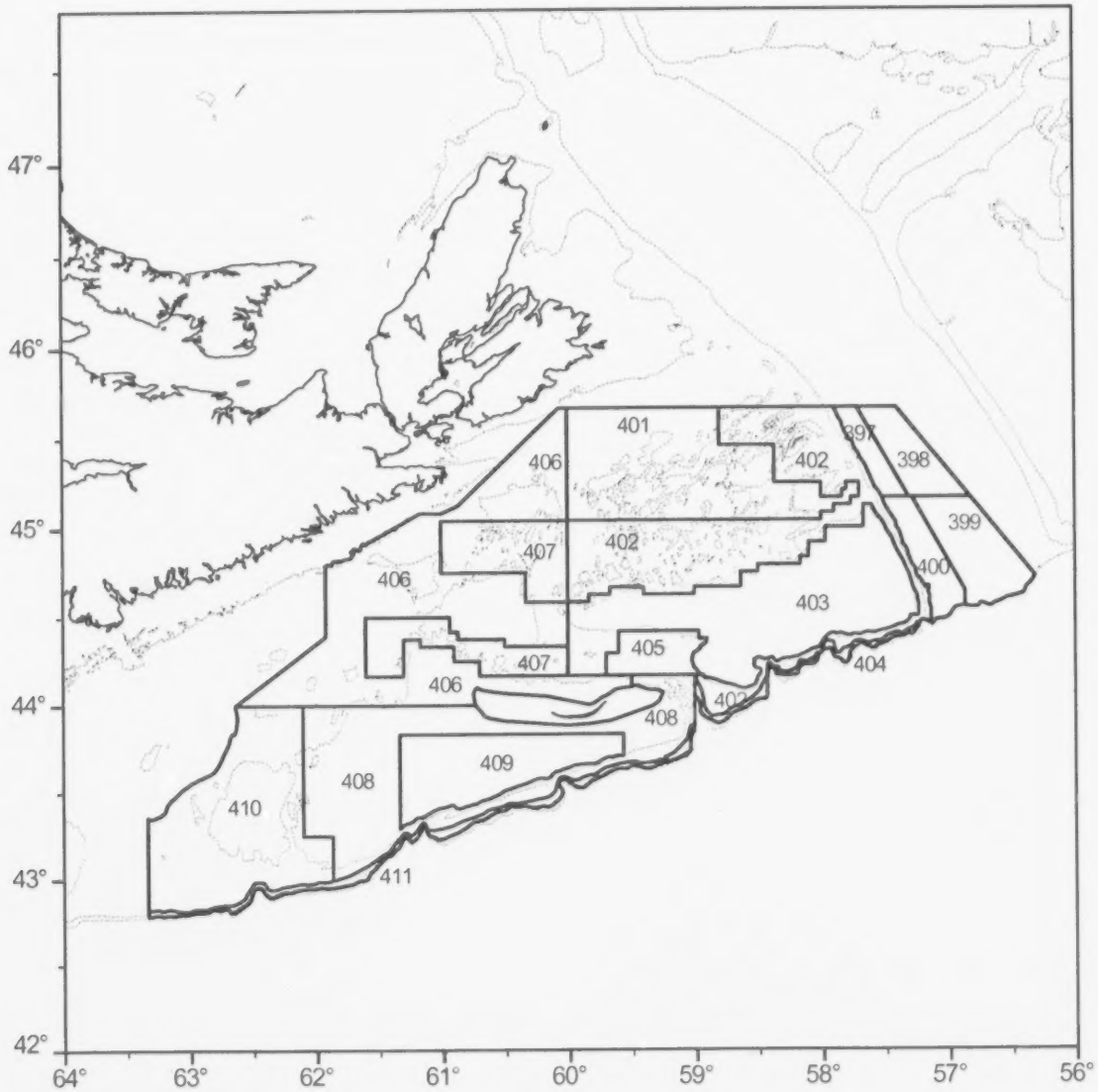


Figure 41. Survey strata used for the 4VsW spring ground trawl survey (1986-2003).

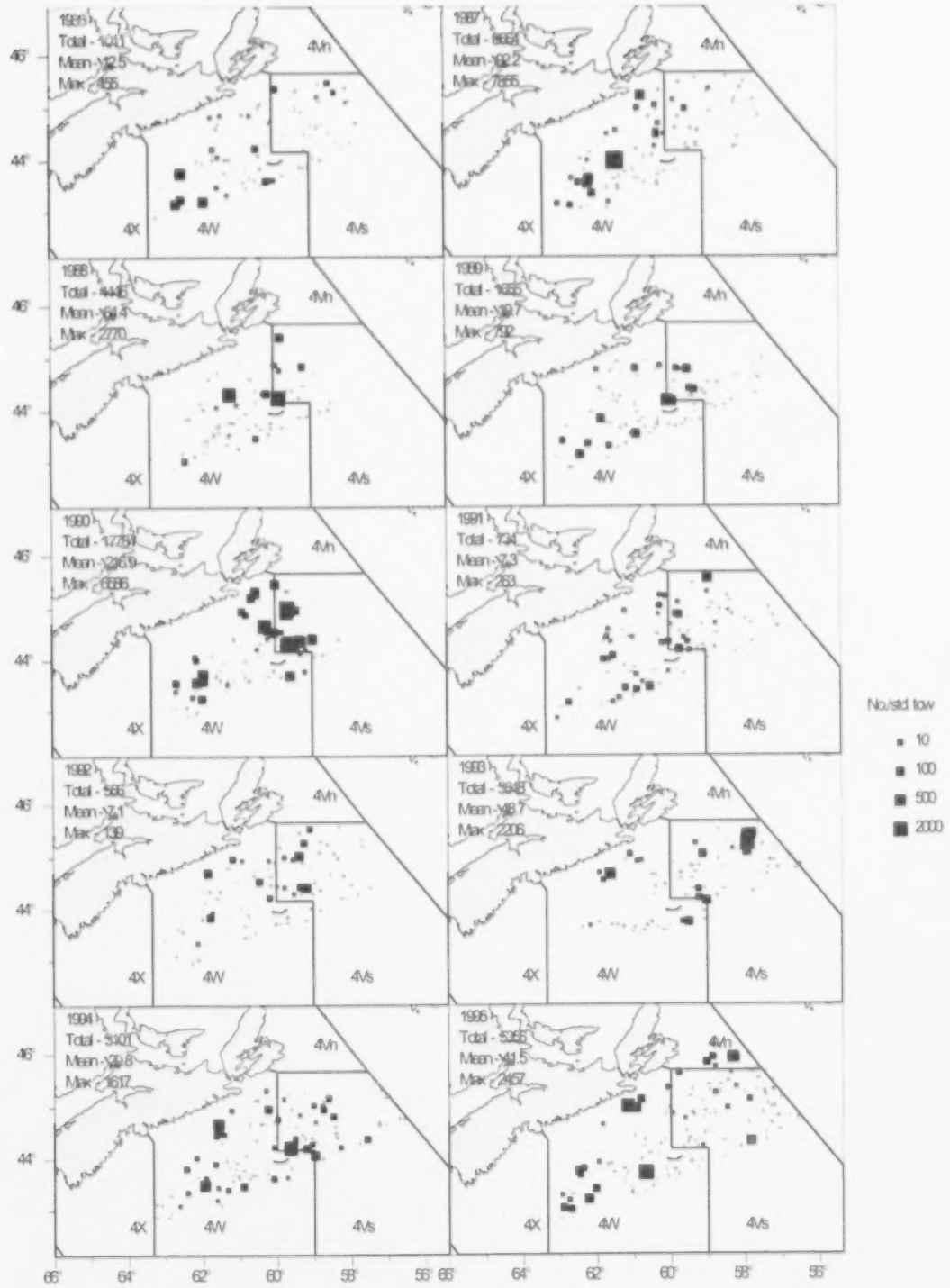


Figure 42. 1986-1995 herring catches (numbers per standard tow) in 4VsW spring ground trawl survey.

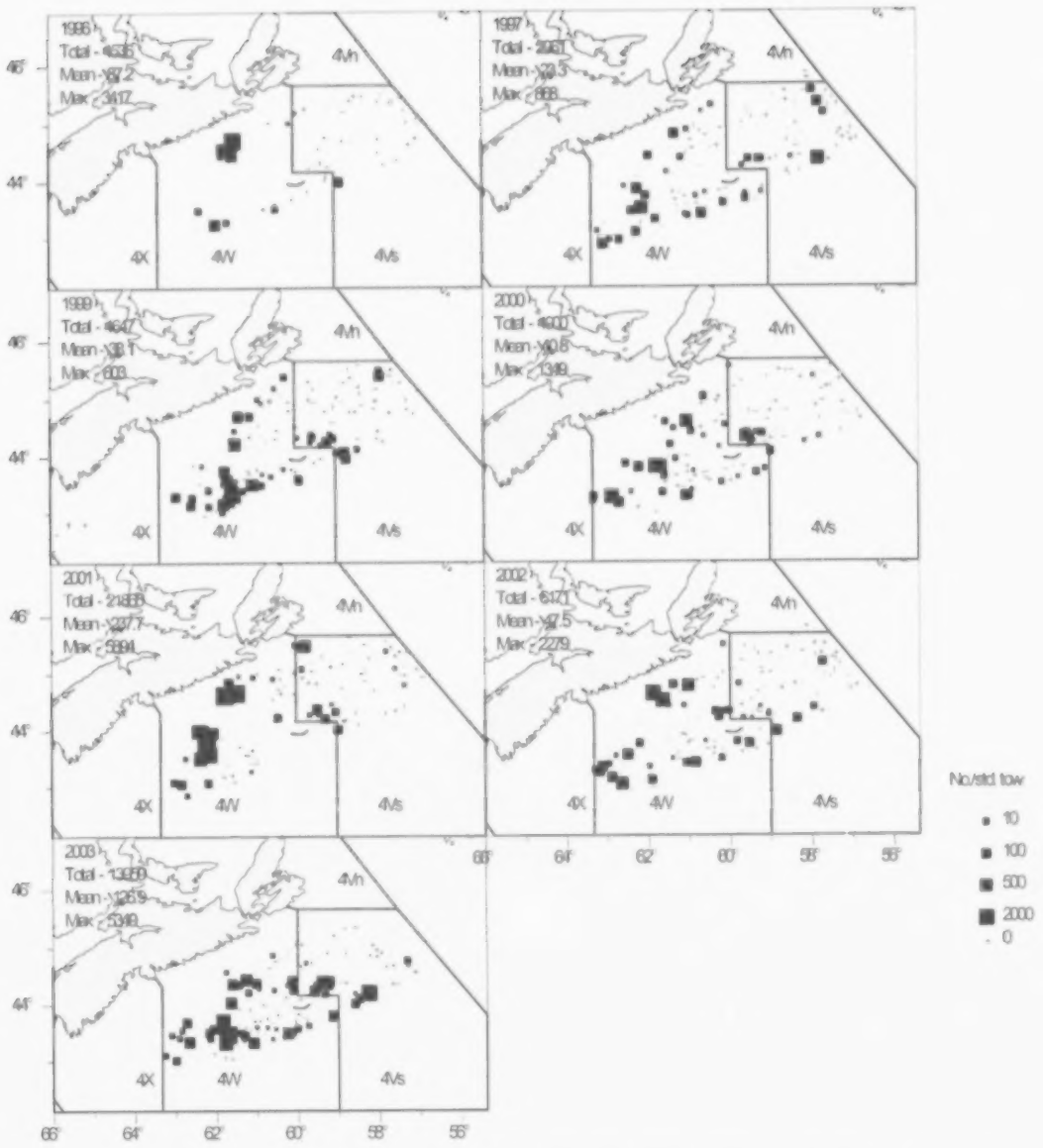


Figure 43. 1996-2003 herring catches (numbers per standard tow) in 4VsW spring ground trawl survey.

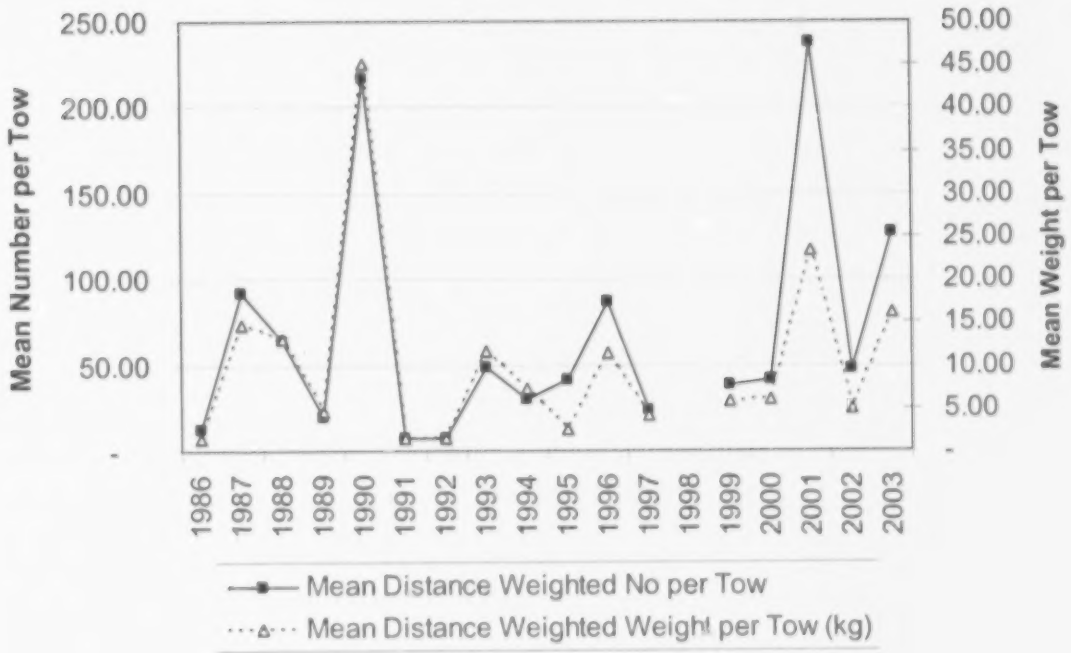


Figure 44. Herring by-catch in 4VsW spring ground trawl survey as distance weighted mean numbers and weight (kg) per tow.

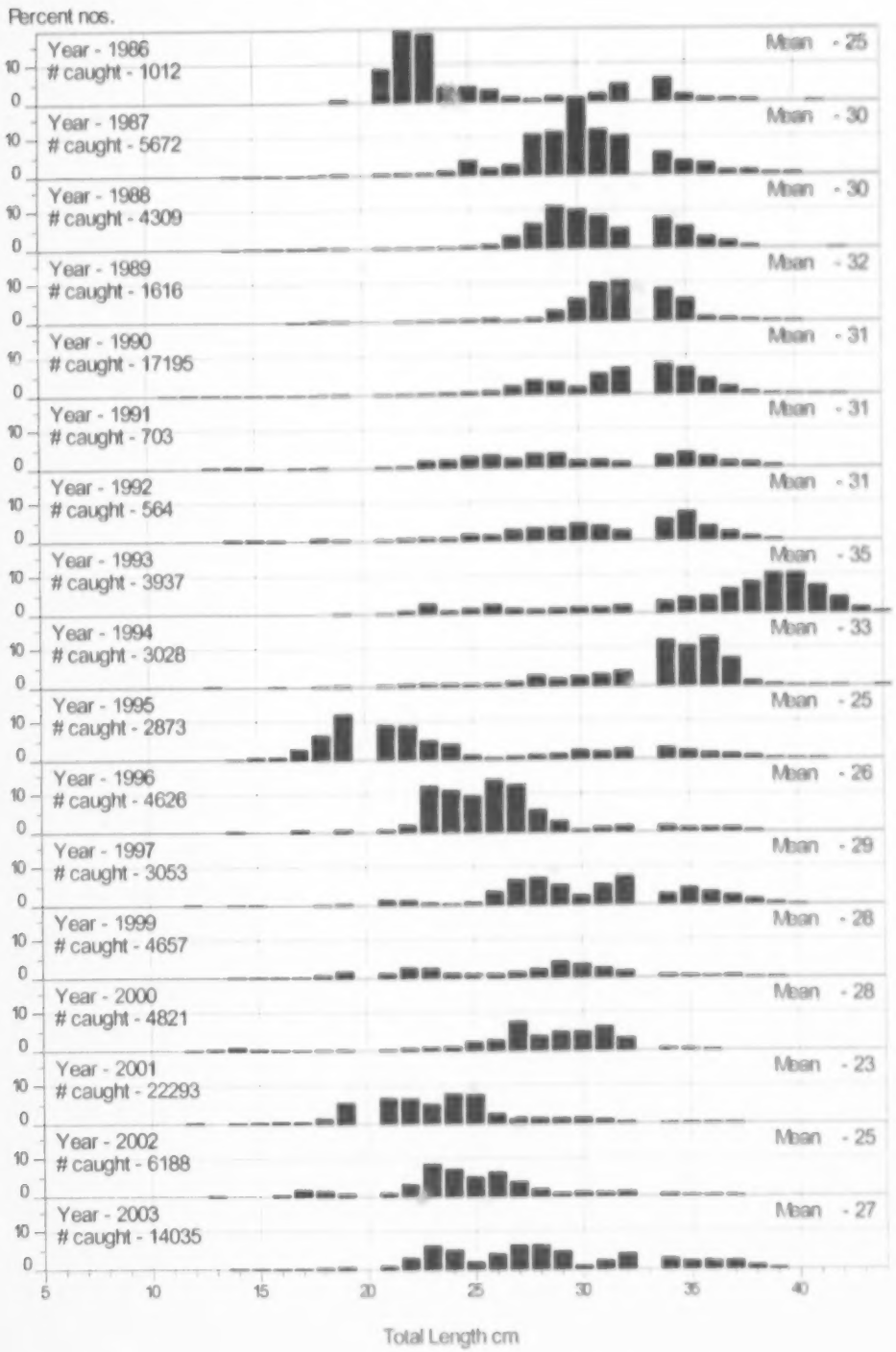


Figure 45. Overall herring size distribution for all strata combined in spring 4VsW bottom trawl surveys from 1986 to 2003 (sizes converted from fork length to total length).

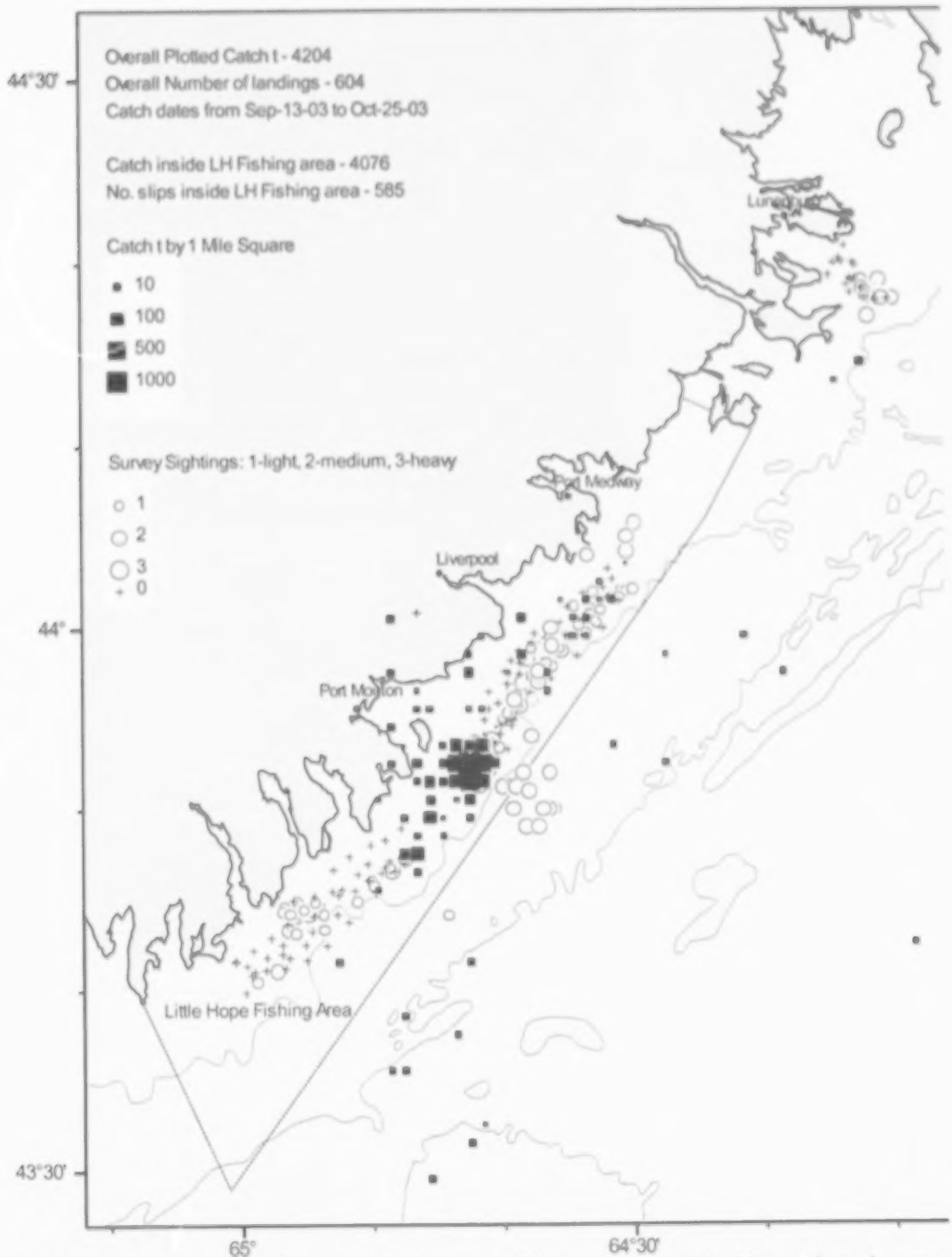


Figure 46. Little Hope/Port Mouton herring gillnet catches (filled boxes) and survey observations (open circles) for the 2003 spawning fishery. Overall and catches inside the Little Hope Fishing area are determined separately.

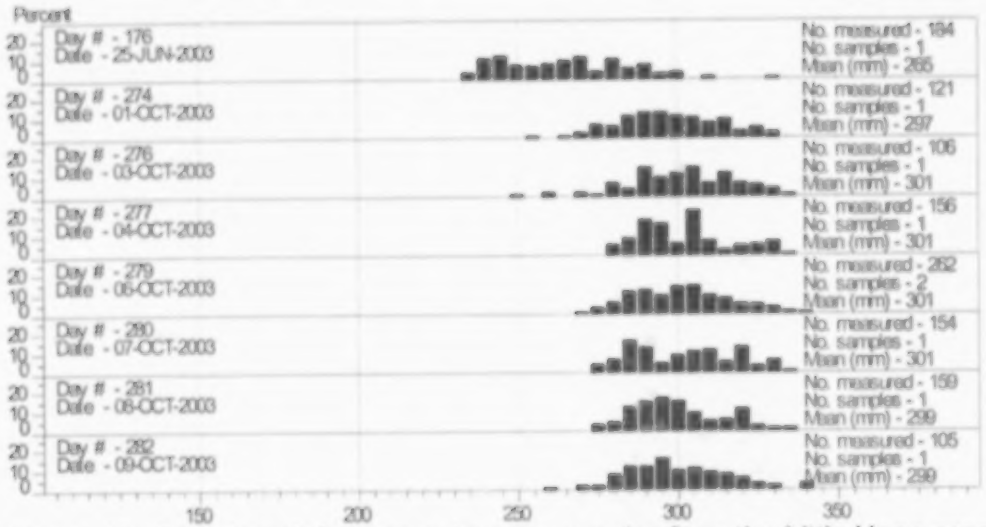


Figure 47. Daily length frequency herring samples from the Little Hope area in 2003.

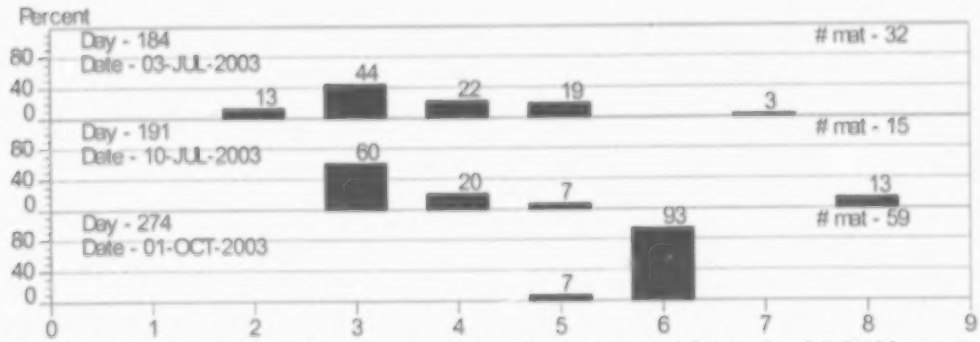


Figure 48. Daily maturity stages of herring sampled from the Little Hope area in 2003.

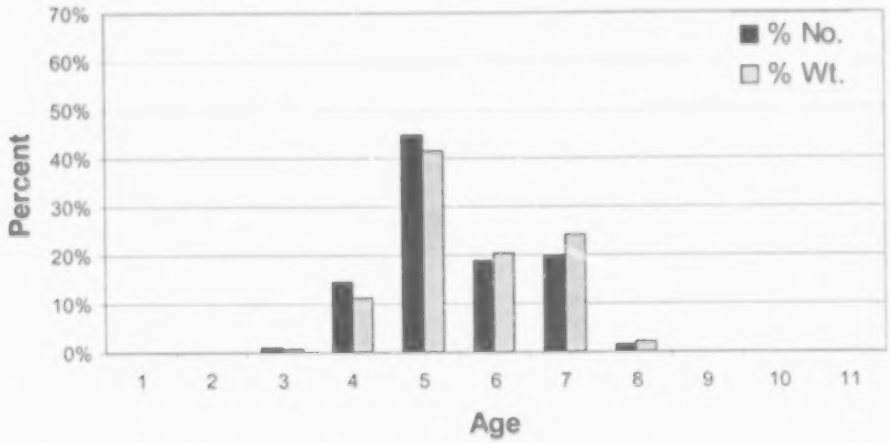


Figure 49. Catch at age (% numbers and % weight) of herring from the 2003 Port Mouton/Little Hope gillnet fishery.

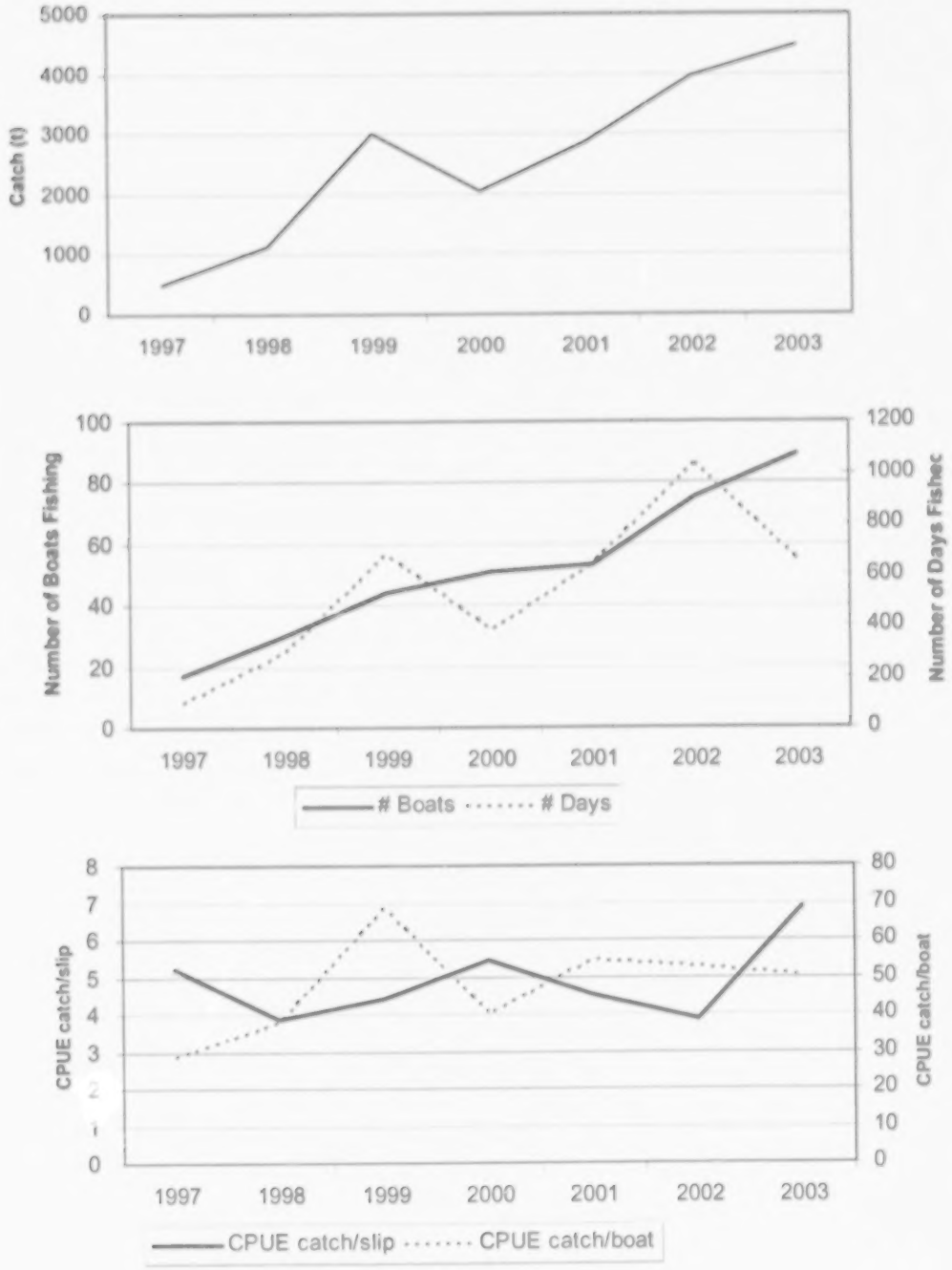


Figure 50. Herring gillnet catch (top panel), effort (middle panel) and CPUE (bottom) for the Little Hope/Port Mouton area for landings in Sept. and Oct. from statistical districts 28 and 30.

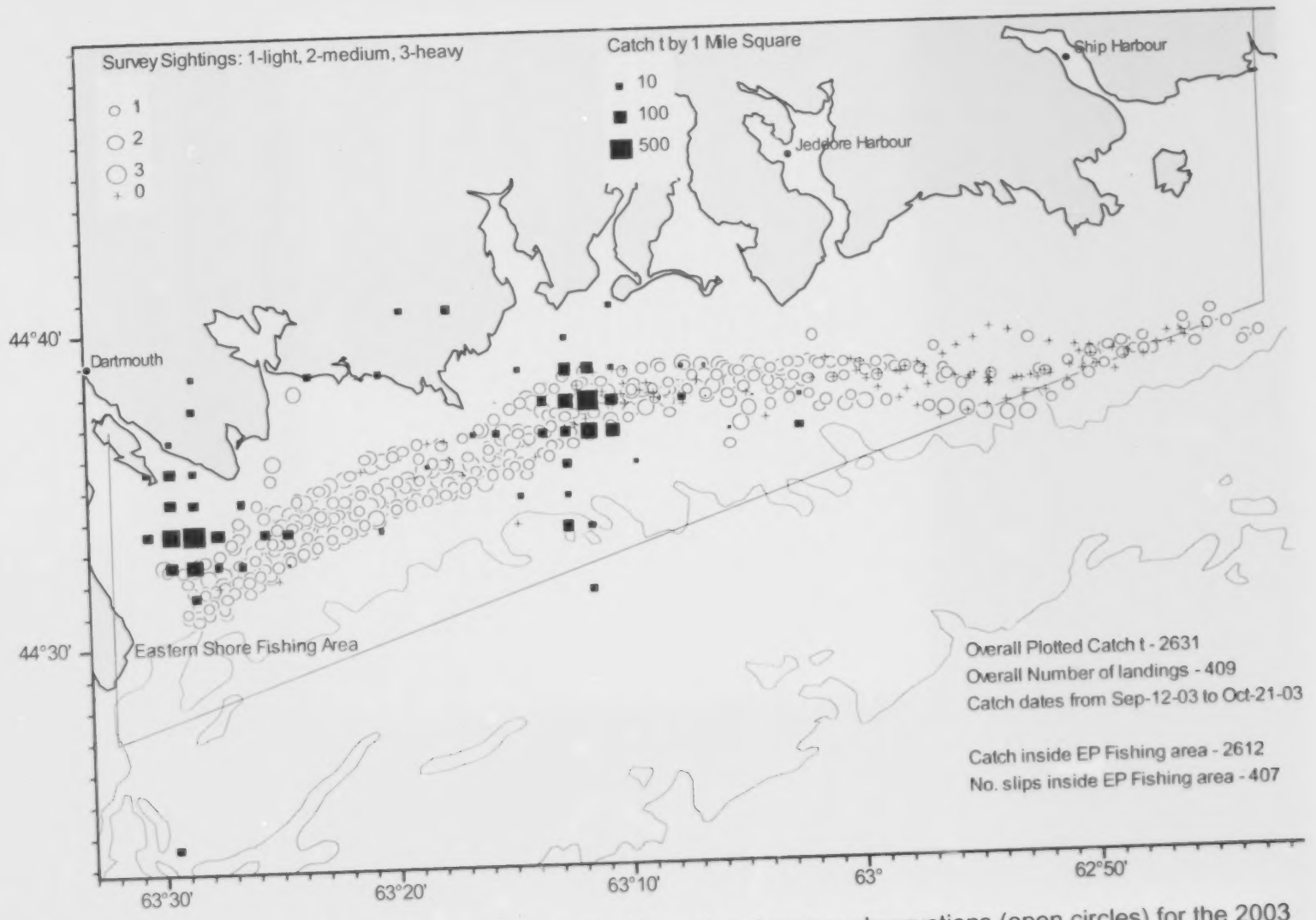


Figure 51. Eastern Shore/Halifax herring gillnet catches (filled boxes) and survey observations (open circles) for the 2003 spawning fishery. Overall and catches inside the Eastern Shore Fishing area are determined separately.

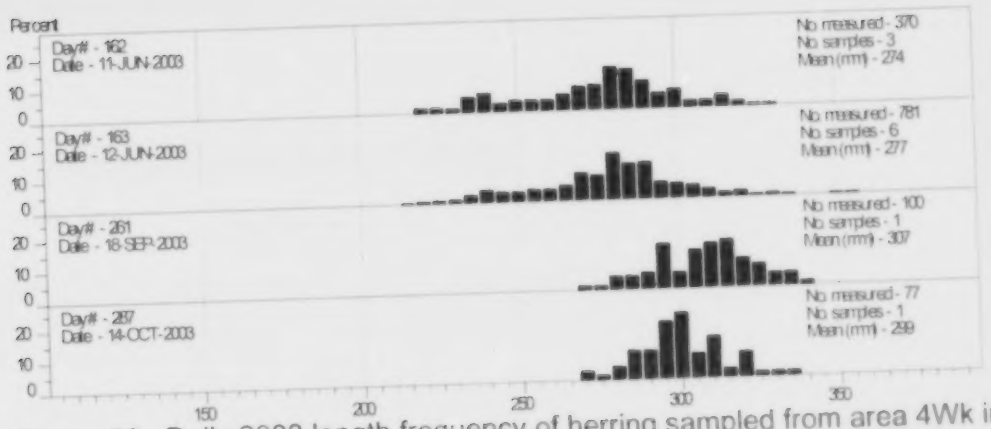


Figure 52. Daily 2003 length frequency of herring sampled from area 4Wk including the Eastern Shore (east of Halifax) area and the Offshore Banks.

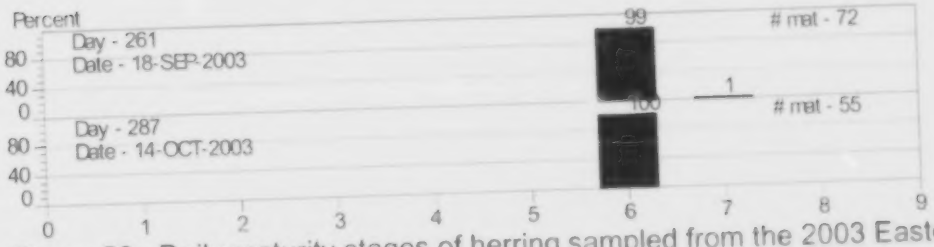


Figure 53. Daily maturity stages of herring sampled from the 2003 Eastern Shore gillnet fishery.

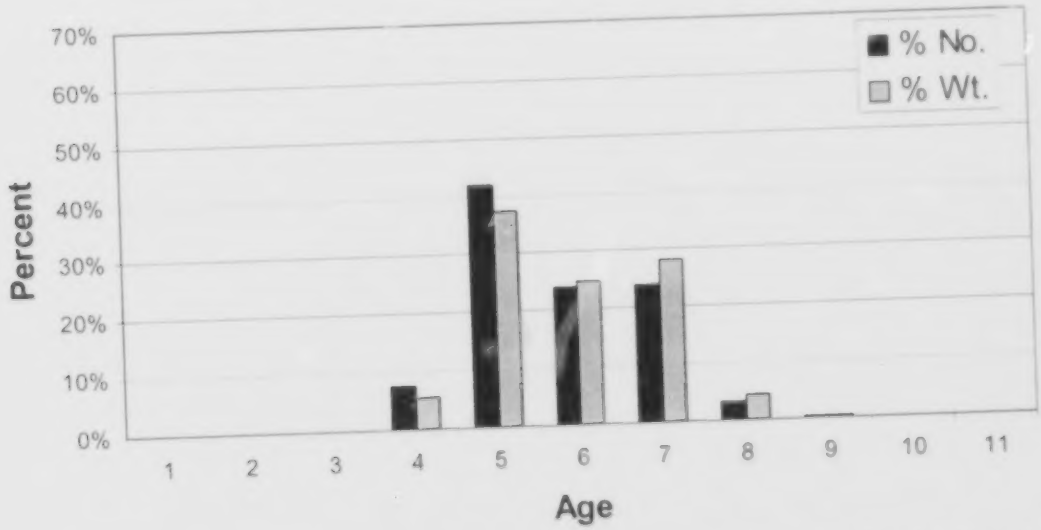


Figure 54. Herring catch at age (% numbers and % weight) for the 2003 Eastern Shore gillnet fishery.

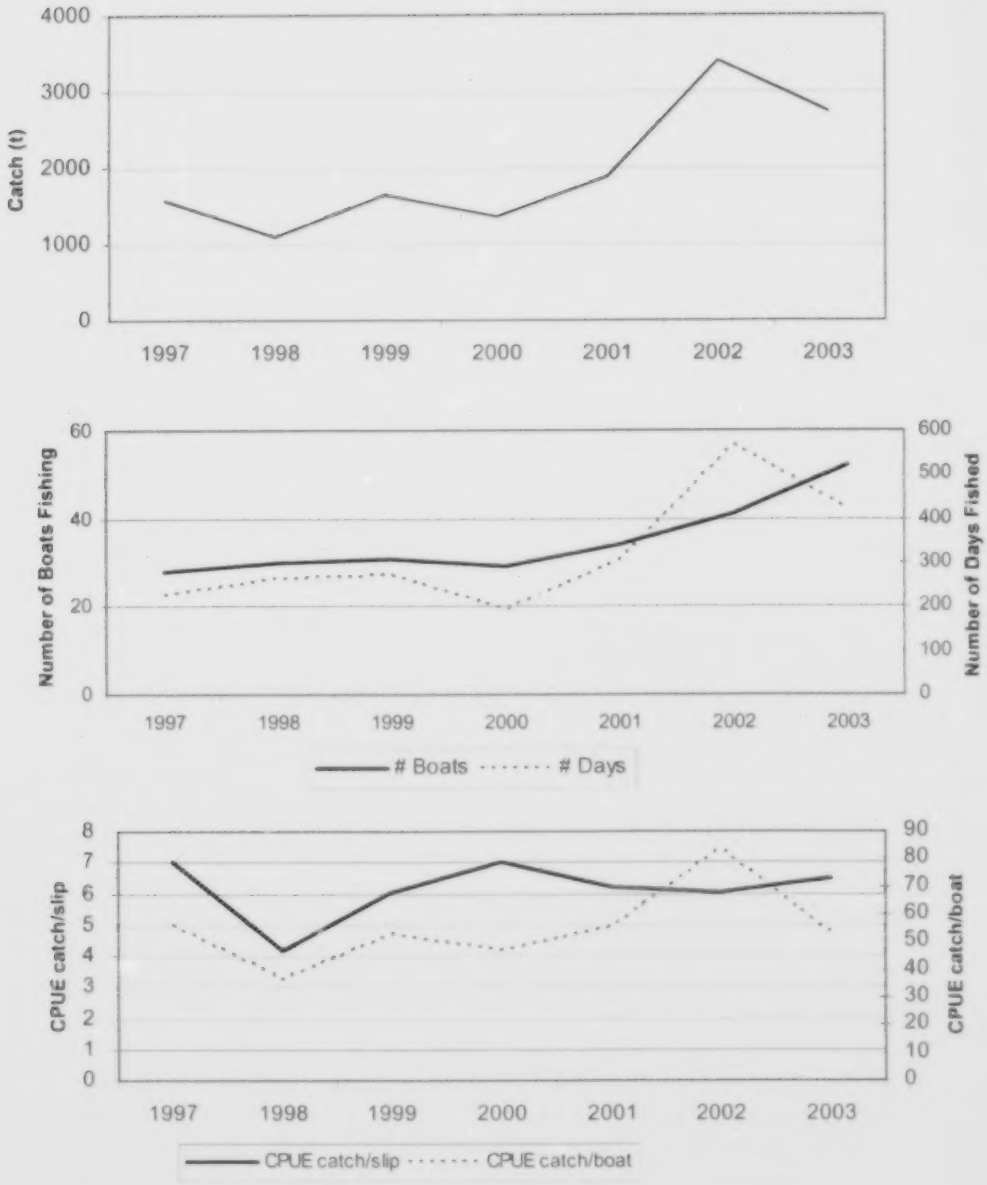


Figure 55. Herring gillnet catch (top panel) effort (middle panel) and CPUE (bottom) for the Eastern Shore/Halifax area from landings in Sept. and Oct. for statistical districts 18, 20, 21 and 22.

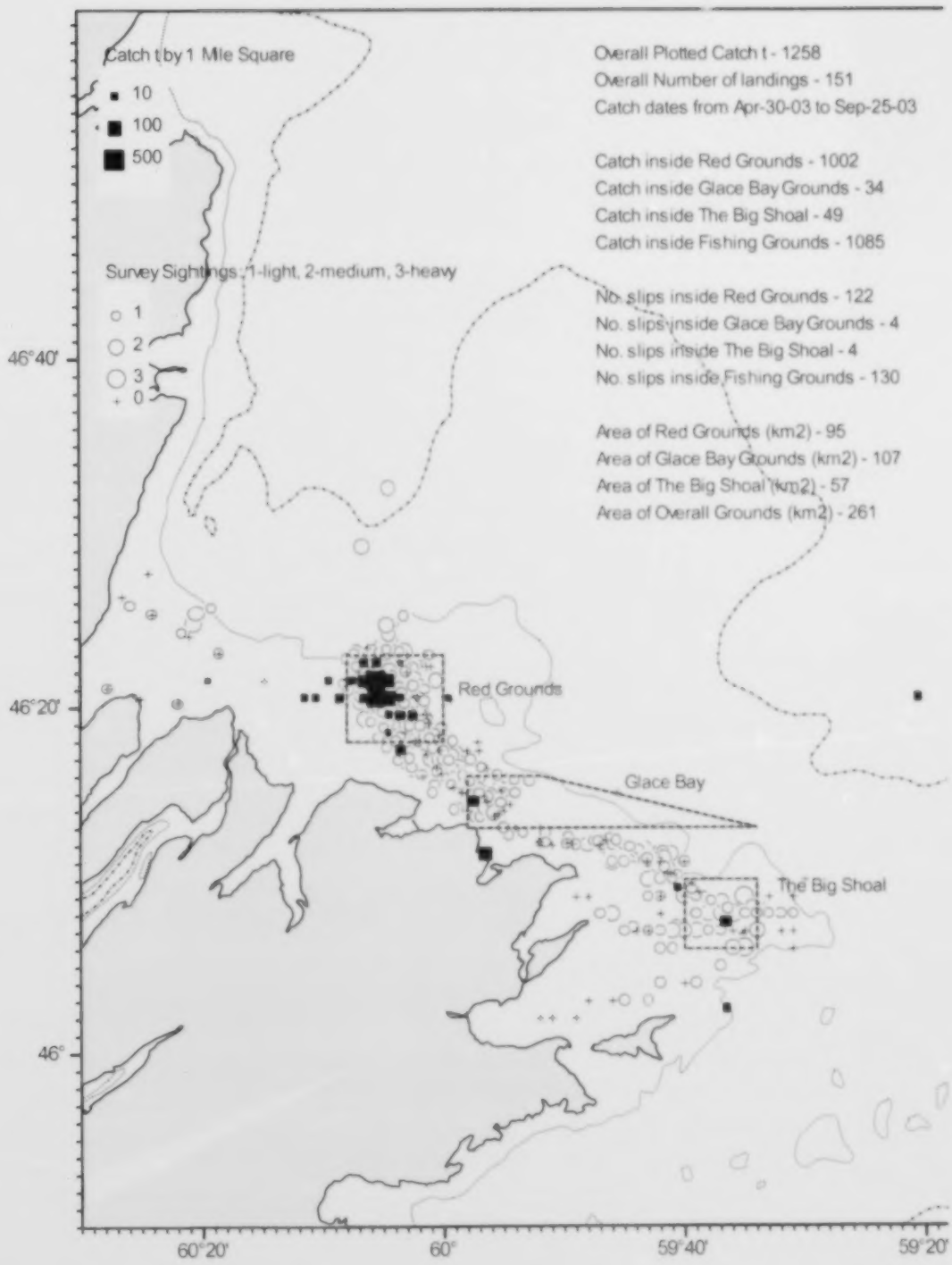

Catch t by 1 Mile Square
10
100
500
Survey Sightings, 1-light, 2-medium, 3-heavy
1
2
3
0
Overall Plotted Catch t - 1258
Overall Number of landings - 151
Catch dates from Apr-30-03 to Sep-25-03
Catch inside Red Grounds - 1002
Catch inside Glace Bay Grounds - 34
Catch inside The Big Shoal - 49
Catch inside Fishing Grounds - 1085
No. slips inside Red Grounds - 122
No. slips inside Glace Bay Grounds - 4
No. slips inside The Big Shoal - 4
No. slips inside Fishing Grounds - 130
Area of Red Grounds (km2) - 95
Area of Glace Bay Grounds (km2) - 107
Area of The Big Shoal (km2) - 57
Area of Overall Grounds (km2) - 261
Red Grounds
Glace Bay
The Big Shoal
46°40'
46°20'
46°
60°20'
60°
59°40'
59°20'

Figure 56. Glace Bay herring gillnet catches (filled boxes) and survey observations (open circles) for the 2003 spawning fishery. Overall and catches inside each of the defined fishing areas are determined separately.

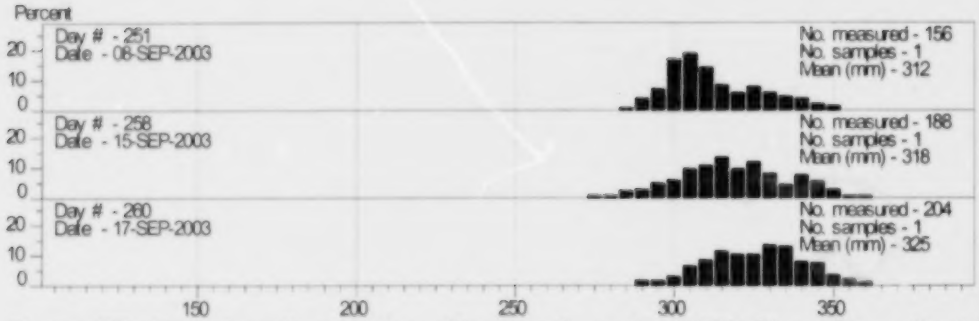


Figure 57. Daily length samples of herring from the 2003 Glace Bay gillnet fishery.

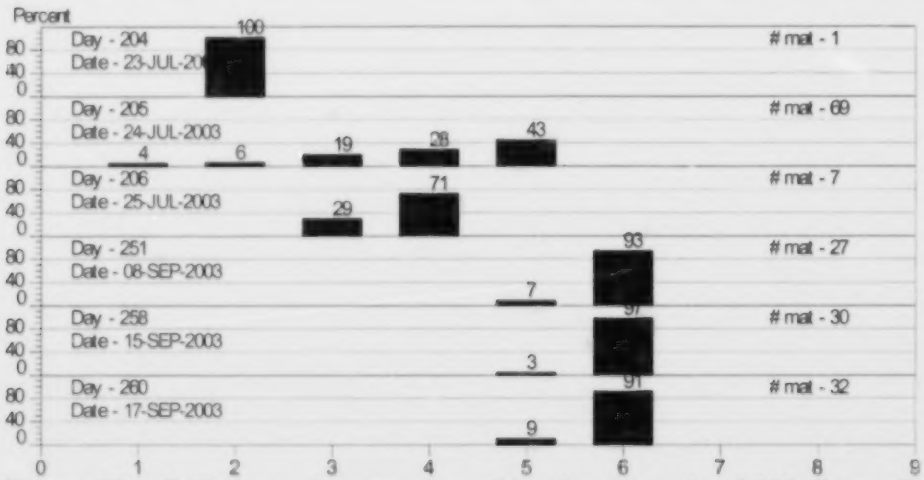


Figure 58. Daily maturity samples of herring from the 2003 Glace Bay gillnet fishery.

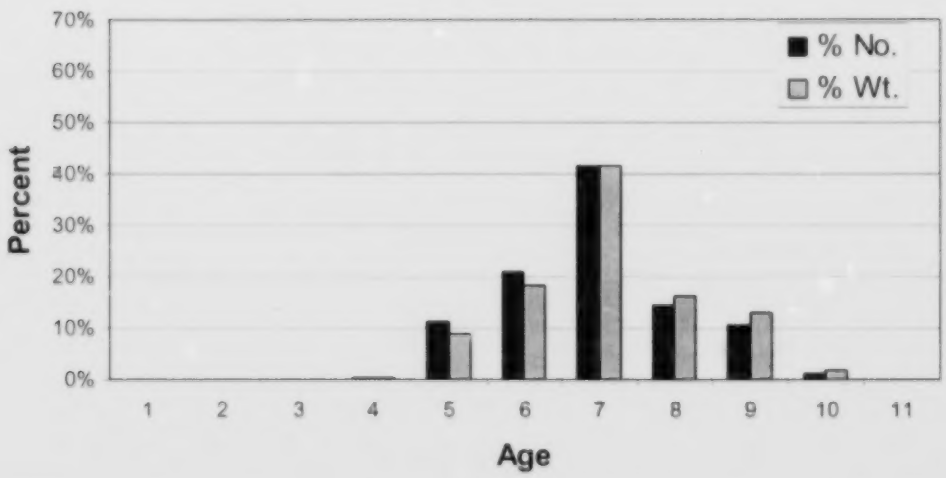


Figure 59. Catch at age (% numbers and % weight) of herring from the 2003 Glace Bay gillnet fishery.

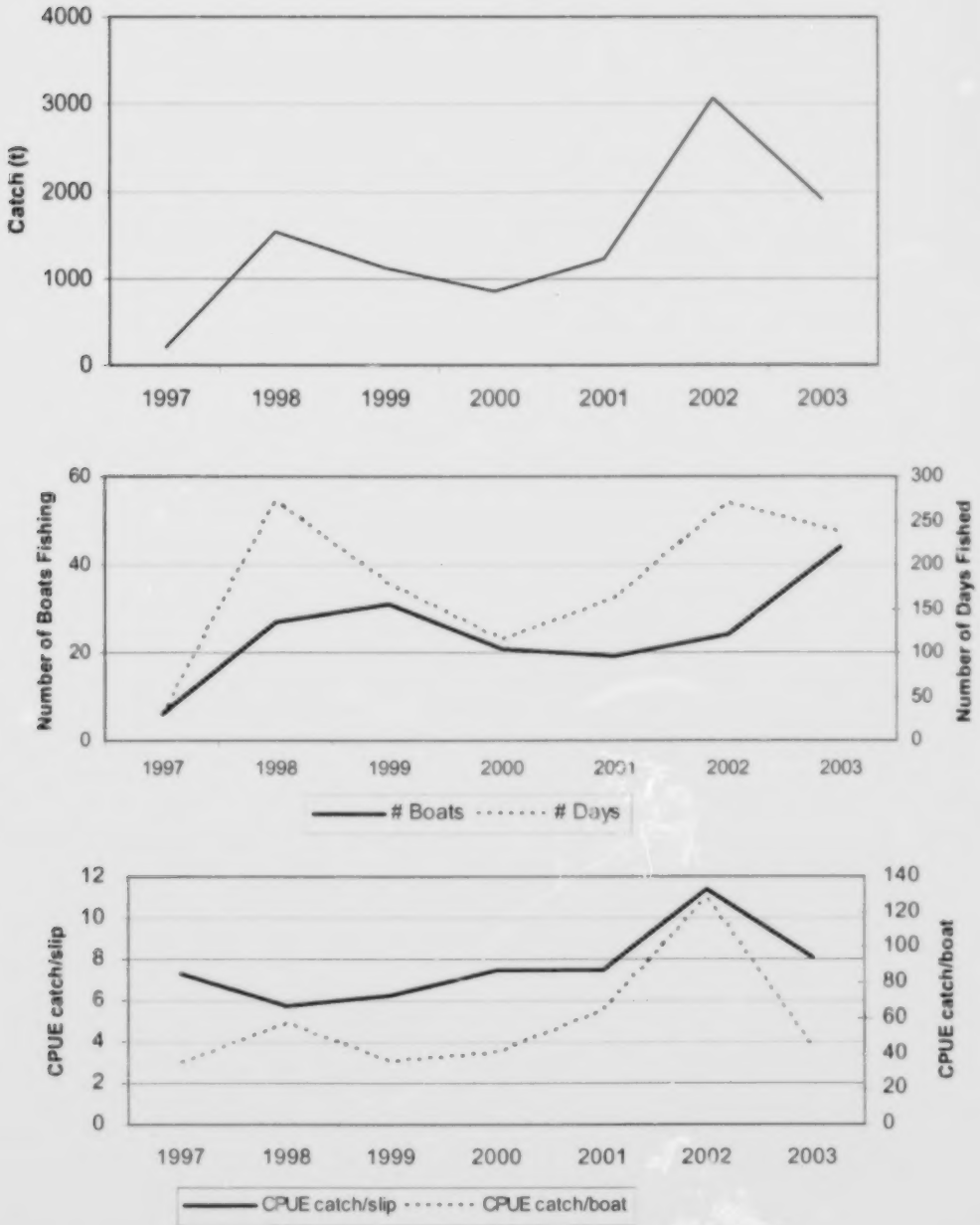


Figure 60. Herring gillnet catch (top panel) effort (middle panel) and CPUE (bottom) for the Glace Bay area from landings in Sept. and Oct. for statistical districts 4, 6 and 7.

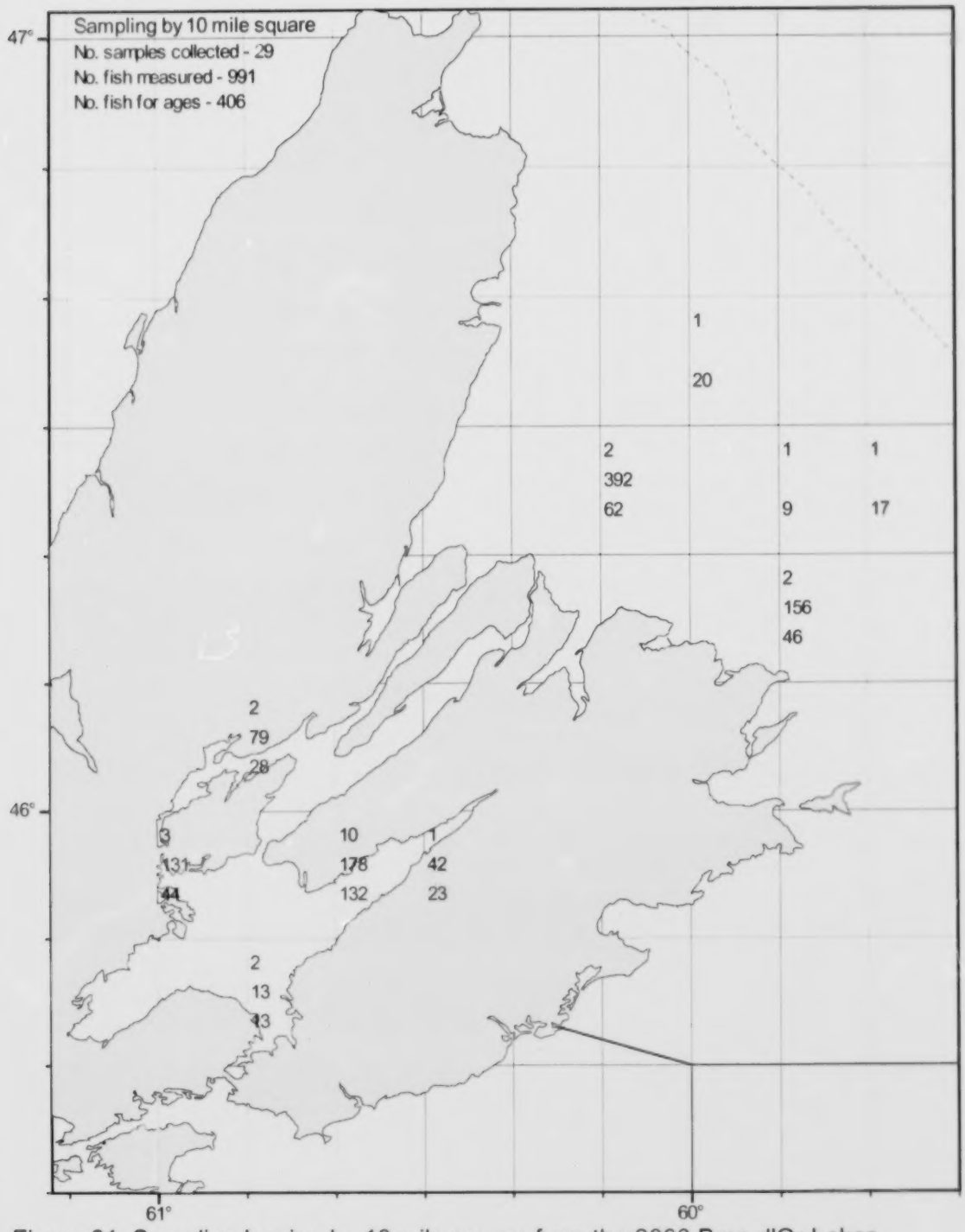


Figure 61. Sampling herring by 10 mile square from the 2003 Bras d'Or Lakes experimental gillnets, the July ground trawl survey and the fall Glace Bay gillnet fishery. Number of samples (top), number measured (middle) and number aged (bottom) are shown in each square.

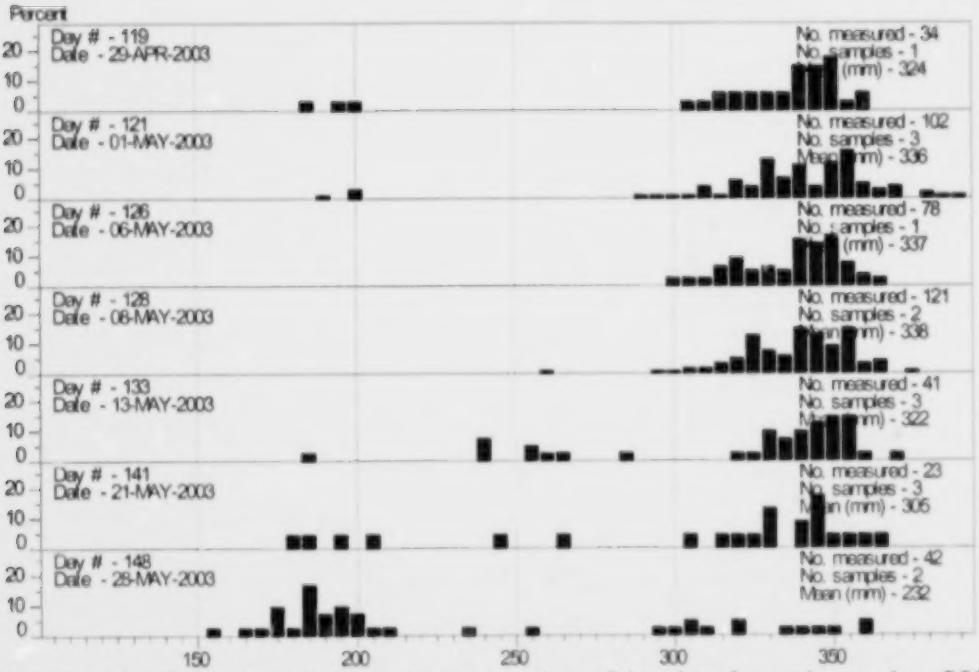


Figure 62. Daily length frequency samples of herring from the spring 2003 Bras d'Or Lakes experimental gillnets.

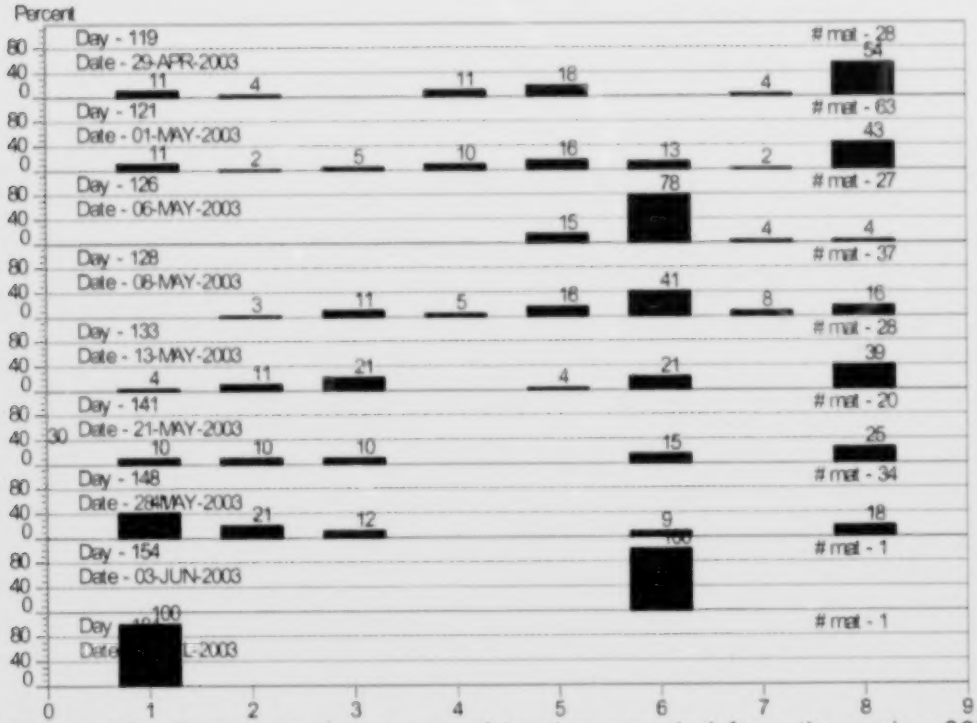


Figure 63. Daily maturity stages of herring sampled from the spring 2003 Bras d'Or Lakes experimental gillnets.

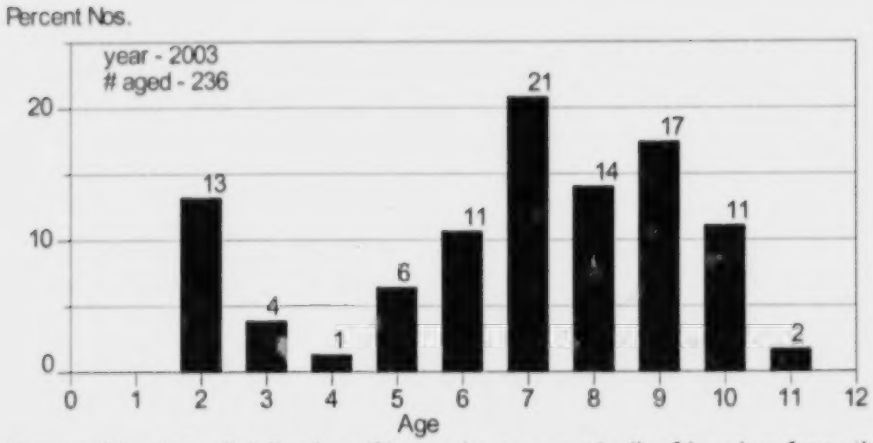


Figure 64. Age distribution (% numbers sampled) of herring from the 2003 Bras D'Or Lakes experimental spring gillnet fishery.

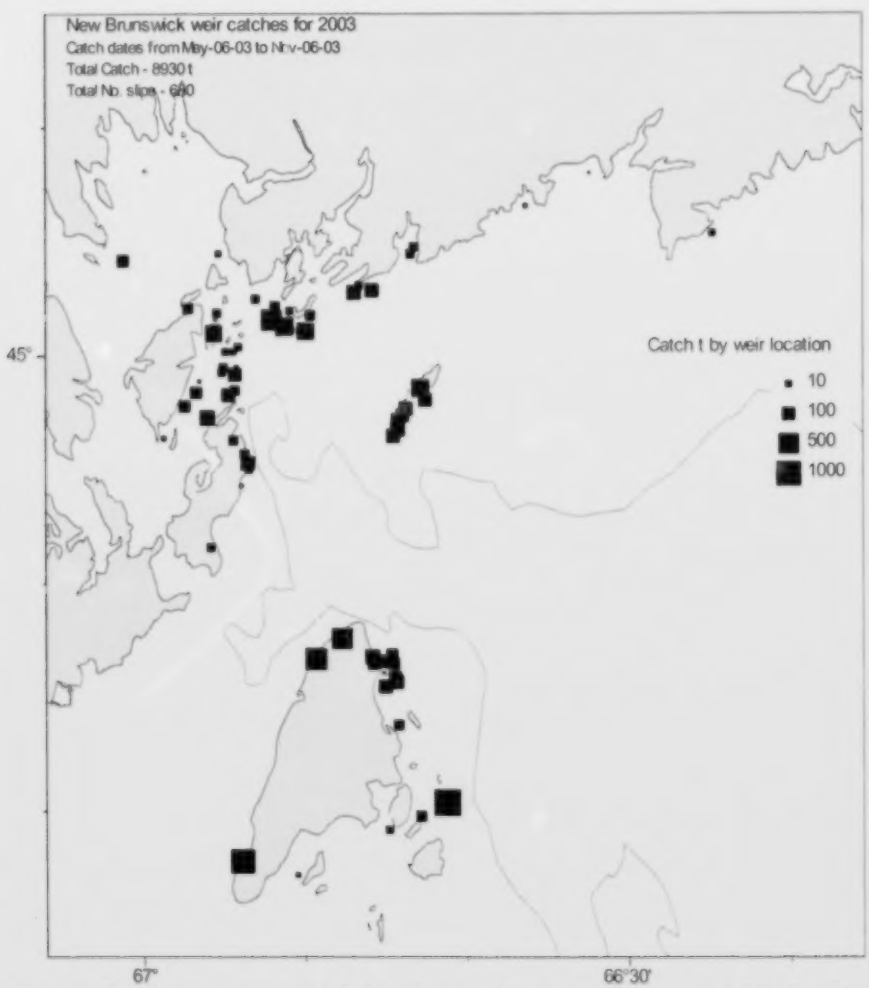


Figure 65. New Brunswick herring weir total catches for 2003 calendar year.

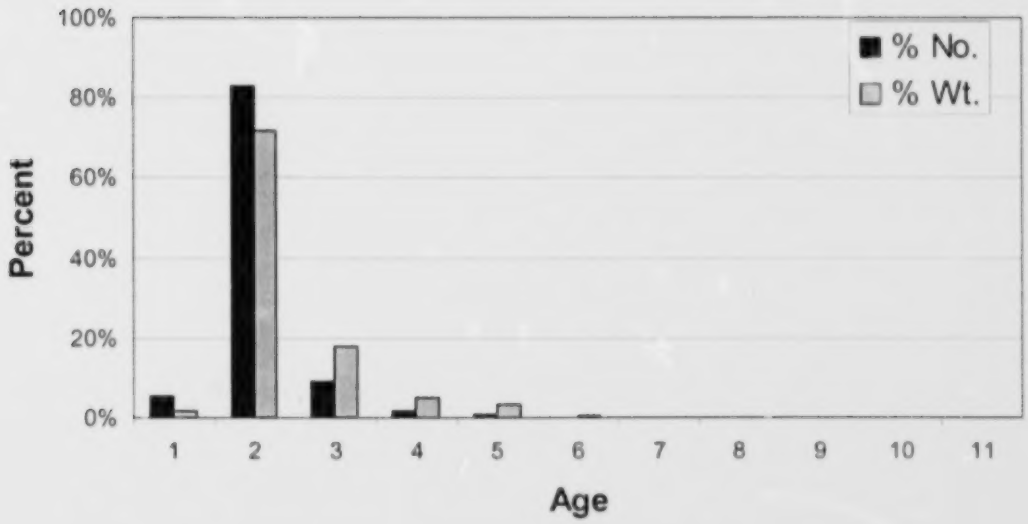


Figure 66. Catch at age (% numbers and % weight) of herring from the 2003 southwest New Brunswick weir and shutoff fisheries.

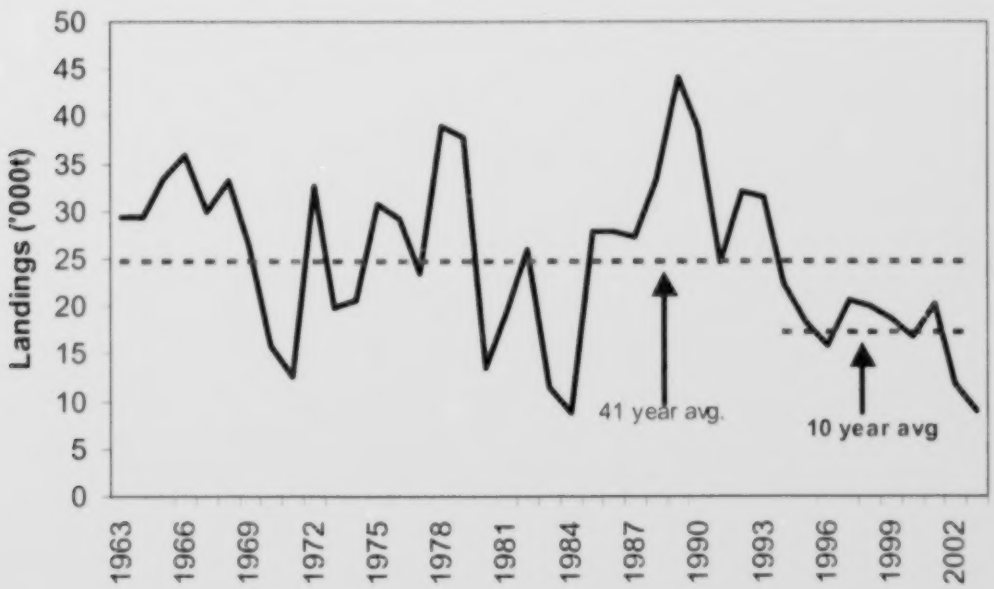


Figure 67. Herring landings from the southwest New Brunswick weir and shutoff fishery, 1963-2003.

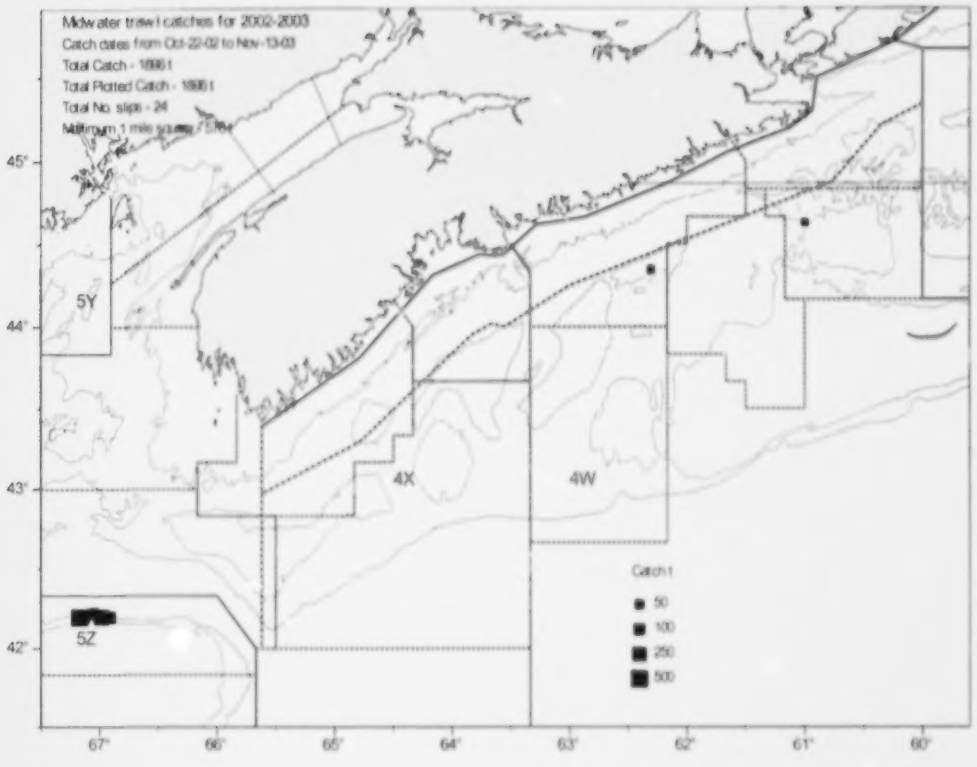


Figure 68. Herring midwater trawler (Morning Star) catches from Georges Bank and the Scotian Shelf from Oct. 15, 2002 to Nov. 13, 2003.

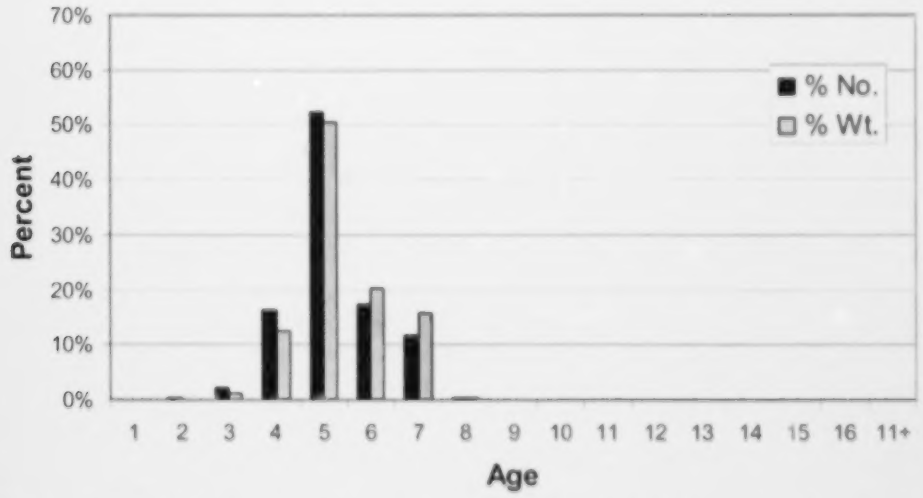


Figure 69. Catch at age (% numbers and % weight) of herring from midwater trawl catches on Georges Bank.

Appendix A: Report of Fleet Activity

2003 4WX Herring Fishery: Report of Fleet Activity

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The herring industry in association with the Herring Science Council provides an annual summary of seiner fleet activity throughout the fishing season. This gives a general overview of the activities of the purse seine fleet and highlights important anecdotal information that may otherwise be lost. Information was gathered through association records, captain's reports and comments, through HSC and DFO staff, and through DFO landings and samples databases. The following is a summary of the activities for the 2002-2003 quota year purse seine fisheries. Please refer to Tables 1-5, and Figures 1-6 to see a graphic organization of the landings per week and length of fish per week.

Offshore/ Scotian Shelf Banks

Summary

- Reactivated fishing area since 1996
- The 2003 Offshore/Scotian Shelf purse seine fishery took place on Weeks 20, 24, and 25.
- Overall, little fish was caught in the Offshore Banks.
- Weather was described as poor for the majority of the 2003 Offshore/Scotian Shelf fishery.
- Fish were scarce and staying deep in the water and were not aggregating well in most evenings. The fish landed were described as being in very good condition with excellent fat content.
- Other non-seining boats reported herring at the edge of the Scotian Shelf.

Week 20: May 11- May 17
This week three landings were made from Western Hole, with a total of 55t landed.

Week 24: June 8- June 14
Eight boats moved around to Halifax this week. Landings were made in Sheet Harbour and Halifax from the Patch. Bad weather prevailed this week. Fish were staying deep in the water column, at 10-11" in length, and were for the food market. 13 landings were made from the Offshore Banks with a total of 722t landed.

Week 25: June 15- June 21
Several boats searched for fish in around the "Bull Pen" at the start of the week. Fish were staying very deep and tight to bottom. The fish could be picked up on sounders, but were unable to be caught. One Captain said that you had to be on top of them when they came up in the water column to catch them. Only a few of

the boats made successful sets. The fleet moved out of this area at the end of the week and headed back to SW Nova Scotia.

South West Nova Scotia Component

The quota year for South West Nova is from the period October 15 to the following October 14, and so catches from October 15 to December 31, 2002 are included in the quota total. The 2003-year fishing weeks are summarized separately below.

Summary

- The purse seine fleet concentrated their efforts on pre-spawning aggregations mainly on the Long Island Shore, the Grand Manan Banks, Gannett Dry Ledge, and Lurcher.
- Spawning aggregations were targeted on German Bank and Scots Bay.
- Weeks 1-8 showed activity in NB Coastal and the Grand Manan Banks. This was different from 2002, where activity was shown in weeks 2-5.
- Fishing started later in the spring, at Week 18: April 27- May 3, compared to 2002 when the fishery started at Week 16: April 13-19.
- The weather varied across the season with some very suitable fishing weather early in the season, to unsuitable weather late in the season.
- In May about 89% of landings came from the Long Island Shore, June the majority was from Grand Manan Banks at 35%, July the greatest was 38% from Scots Bay. In both August 57% of the landings came from Scots Bay, September the majority was from German Bank at 65%. The month of October had 48% of landings coming from the Grand Manan Banks.

2002 Fishing Weeks

Week 42: October 15- October 19
426 tons (6 landings) of herring was landed in NB Coastal, and 1339 tons (26 landings) in Grand Manan.

Week 43: October 20- October 26
529 tons (16 landings) was landed on the Grand Manan Banks, 986 tons (12 landings) in NB Coastal, and 110 tons (1 landing) on the Long Island Shore.

Week 44: October 27- November 2
445 t were landed in Grand Manan from 10 landings, and 559 in NB Coastal from 15 landings.

Week 45: November 3- November 9
382 t was landed on the Grand Manan Banks from 9 landings, and 73t were landed in NB Coastal from 1 landing.

Week 46: November 10- November 16

533t was landed on the Grand Manan banks from 6 landings, and 78t on the Long Island Shore from 1 landing.

Week 47: November 17- November 23
482t was landed on the Grand Manan banks this week from 6 landings.

Week 48: November 24- November 30
406t was landed on the Grand Manan banks this week from 6 landings.

Week 49: December 1- December 7
111t was landed on the Grand Manan banks this week from 2 landings, and 18t on the Long Island Shore from 1 landing.

2003 Fishing Weeks

Week 1: January 1- January 4
655t of herring was landed in NB Coastal from 16 landings to start out the year 2003.

Week 2: January 5- January 11
301t was landed in NB Coastal from 14 landings, 235t (10 landings) in Grand Manan.

Week 3: January 12- January 18
293t was landed in NB Coastal from 13 separate landings.

Week 4: January 19- January 25
270t (13 landings) was landed in NB Coastal and 39t (2 landings) in Grand Manan.

Week 5: January 26- February 1
78t (6 landings) were landed in NB Coastal, and 99t (5 landings) in Grand Manan.

Week 6: February 2 - February 8
158t (9 landings) was landed on the Grand Manan Banks, and 88 t (5 landings) was landed in NB Coastal.

Week 7: February 9 - February 15
130t from 5 landings was landed in NB Coastal.

Week 8: February 16- February 22
12t were landed from one landing in Grand Manan Banks, and 25t from 2 landings in NB Coastal.

Appendix A: Report of Fleet Activity

Week 18: April 27- May 3
35 tons was landed on the Gannet Dry Ledge this week from 4 landings. 71 tons of herring was caught on German Bank this week fro a total of 7 landings.

Week 19: May 4- May 10
494 t was caught on the Long Island Shore this week, from a total of 11 landings. 300t was captured from Lurcher this week from 11 landings. 52 t from Gannet Dry Ledge from 2 landings. 16 t was gathered from German Bank from a total of two landings.

Week 20: May 11- May 17
103t (5 landings) was caught on Grand Manan, and 1510 t (41 landings) from Long Island Shore.

Week 21: May 18- May 24
14 t (2 landings) of herring was landed in Grand Manan this week, and 1152 t (36 landings) of herring was landed on the Long Island Shore.

Week 22: May 25- May 31
Several seiners fished the Long Island Shore this week. Herring was in good amounts and were bunching up well in the water. 590 t of herring was landed this week from the Long Island Shore, from a total of 23 landings.

Week 23: June 1- June 7
7 gillnet boats fished on Green Island/Spectacle Buoy area this week. A good amount of spawning fish was observed and recorded. 473t (17 landings) of herring was landed from the seiners this week in Grand Manan. An additional 82t (3 landings) was landed on the Long Island Shore.

Week 24: June 8- June 14
347t (13 landings) of herring was landed in Grand Manan, and 82t (3 landings) was landed on the Long Island Shore.

Week 25: June 15- June 21
480t (19 landings) of herring was landed in Grand Manan, 149t (7 landings) was landed on the Long Island Shore, 6t (1 landing) from the Gannett Dry Ledge, and 80t (1 landing) from German Bank. Some seiners moved around to Halifax this week. An inshore gillnet survey of Spectacle Buoy/ Green Island area was carried out on Sunday June 8, 2003. 10 gill-netters participated in the survey. Very little fish was found in comparison with the sightings from the previous week.

Week 26: June 22- June 28
The seining fleet moved from the Offshore Banks back to Southwest Nova Scotia this week. Very little herring was observed this week. Sets made in the area produced "junk". The water temperature was fairly warm between 54.3 and 55^{0}F. Despite the lack of herring, 161t (6 landings) was landed on Grand Manan, 620t

(20 landings) was landed on the Long Island Shore, 1096t (16 landings) was landed in the Seal Island Area, and 223t (5 landings) was landed from German Bank.

Week 27: June 29- July 5
Good amounts of herring were landed this week for the food market. Approximately 10 boats were active south of the Seal Island area. The water temperature ranged from 50-54^{0}F, and the weather was described as good. Fish size ranged between 10-13 inches. These fish are thought to be of the 1998-year class, and were caught full fat and full of feed. The Teardrop, 28 miles southwest of Yarmouth, was also fished, and again large fish full of feed were encountered.1148t (35 landings) was landed from Grand Manan, 22t (1 landing) from the Long Island Shore, 34t (1 landing) from Lurcher, 3651t (47 landings) from Gannet Dry Ledge, and 795t (12 landings) from German Bank.

Week 28: July 6- July 12
Seiners fished the Teardrop and an area North of German Bank this week. Good amounts were landed. Fish size was good (9-11 inches), with an excellent size range depicting various year classes. Fat content of the fish was very good, anywhere from 13-15%. Fish caught were excellent size for fillets. Fish were staying deep in the water column, and only coming up after dark. 722t (33 landings) was landed from Grand Manan, 212t (5 landings) was landed from Long Island Shore, 1240t (17 landings) was landed from Lurcher, 1725t (20 landings) was landed from Gannet Dry Ledge, and 99t (2 landings) was landed from German Bank.

Week 29: July 13- July 19
A good amount of fish was noted on the evening of July 14 on the Long Island Shore. This was not roe fish, but a good sign of what may be to come. Whales were observed off White Head this week. Fish on German Bank were appearing suddenly, when darkness fell, there would be lots of fish showing in the area. Some felt that the transition from no fish showing on the sounders to plenty of fish was stronger this year. This week several seiners moved operations to Scot's Bay. Landings were made over a variety of areas, including 139t (4 landings) on Grand Manan, 1177t (48 landings) on the Long Island Shore, 128t (2 landings) on Lurcher, 391t (7 landings) on Gannet Dry Ledge, 687t (12 landings) on German Bank, and 1187t (12 landings) in Scot's Bay.

Week 30: July 20- July 26
Fishing activity was mainly concentrated on the Long Island Shore and Scot's Bay this week. It was reported that in Scot's Bay this week fish were not yet in quantities to warrant the first survey of the season in that area. The fish were in small bunches and were in hard condition. Fish were generally seen off of Margaretsville. 1057t (37 landings) of herring was landed on the Long Island Shore, 18t (1 landing) on German Bank, and 1919t (33 landings) in Scot's Bay.

Appendix A: Report of Fleet Activity

Week 31: July 27- August 2
This week several seiners concentrated on Scot's Bay. The first survey of Scot's Bay was conducted on the evening of July 31. Many of the Captain's felt that the 31st was not a good night to survey, and many felt that the fish were showing up later this year than in previous years. This survey was attended by a representative from DFO Science. This week 5562t (56 landings) were landed in Scot's Bay, 149t (2 landings) in German Bank, 289t (10landings) in Grand Manan, and 353t (17 landings) in Long Island.

Week 32: August 3- August 9
Scot's Bay was active again this week, with the majority of the weekly landings coming from that area (4189t from 53 slips). Late into the week, it was being discussed if there should be a survey this week. By Friday it was decided that the second survey of Scot's Bay should be on the following Sunday. Fish this week was landed in three other areas: 495t (12 landings) in Grand Manan, 405t (13 landings) on Long Island and 387t (4 landings) on German Bank.

Week 33: August 10- August 16
Week 33 started out with a Sunday night survey, August 10th in Scot's Bay. There was great participation in the survey, and a good amount of fish was documented that night. This survey was directed by a representative of the Herring Science Council. The week went on with high landings in Scot's Bay, 3763t from 46 slips. Other areas showed 361t (16 landings) from Grand Manan, 90t (3 landings) from Long Island Shore, 172t (5 landings) from Gannet Dry Ledge, and 99t (2 landings) from German Bank.

Week 34: August 17- August 23
Landings this week decreased in Scots Bay to 1601t (26 landings), however they increased slightly in Grand Manan (751t), and German Bank (599t). Again, toward the end of the week discussions were held to decide if there should be another survey. A survey was then planned for the night of Sunday August 24 in Scots Bay.

Week 35: August 24- August 30
The third survey of Scots Bay was completed this week on the evening of August 24. Representatives from DFO Science and the Herring Science Council participated in this survey. Landings in Scot's Bay dramatically dropped this week to 636t with most boats moving out of the area. Six boats fished German Bank this week. Fish were staying deep and were reported to be in the 10-11 inch range. These fish were also in roe and food condition. The weather was good overall for the week. The first survey of German Bank was completed on August 29. This was a non-fishing survey and was run by the fisherman and the industry associations. Landings in German Bank increased greatly, with a grand total of 3813t from 43 landings. Landings were also made from Grand Manan (349t), Long Island Shore (31t), Lurcher (59t), and Gannet Dry Ledge (55t).

Week 36: August 31- September 6
This week the weather was good, except one day (September 5) that was bad. Between eight and ten vessels fished German Bank this week. The fish were reported as being in the range of 10-11 inches, and were in roe condition. The water temperature was 52-53°F. Fish were staying tight to bottom and were showing up good on the sounders. The total landings from German Bank were 3737t. On the evening of September 6th, several seiners moved back into the Scots Bay area to survey. Not a great amount of fish was documented, and only 339t were landed that week from 3 landings. Landings also came from Grand Manan (551t), Gannet Dry Ledge (187t), and Long Island Shore (125t).

Week 37: September 7- September 13
The weather was good all week. 10 herring seiners fished German Bank this week. The fish were staying deep in the water column and were in roe condition. The second German Bank survey of the season was conducted on September 8th. This was a non-fishing night, with good amounts of fish noted on the Spawn Tow. The water temperature was 53°C all week and the fish on the Spawn Tow were at a depth of 33 fathoms. Over the duration of the week, most of the boats were able to get their fish in one set. The fish were described as being more plentiful than last year, and the fish were staying closer to the bottom. Landings in German Bank totaled 5406t (64 landings). 229t was also landed in Grand Manan, 406 on the Long Island Shore, and 178 on Gannet Dry Ledge.

Week 38: September 14- September 20
10 boats fished German Bank this week and landed a total of 3281t of herring. The fish were in roe and food condition. All boats seemed to get the fish they needed over the week's activities. Fish were showing up well on the Spawn Tow, at depths of 33 fathoms and with a water temperature of 53°C. The night of September 18th was the third German Bank survey. This was once again a non-fishing night. The Captains felt the survey went very well, with eight boats participating. Other areas fished were Grand Manan (1029t), Long Island Shore (239t), and Gannet Dry Ledge (178t).

Week 39: September 21- September 27
The weather was good this week. Between eight and nine seiners fished German Bank (307t) this week. The fish caught were in roe condition. The fish at the start of the week were showing on the sounders as a skimmer on bottom, but most vessels were able to get the fish they needed. On the nights of the 23rd and 24th, there was a great amount of fish noted to the east of the Spawn Tow. Toward the end of the week, many boats moved on for bait and were fishing on the Grand Manan Banks (2896t landed).

Week 40: September 28- October 4
The weather this week was not great for fishing. Hurricane Juan moved through the Halifax area on the evening of September 28. The remainder of the week showed windy conditions. German Bank was almost inactive this week. Most of

the seiners were fishing for the bait market, and were concentrating on the Grand Manan Banks, landing a total of 3327t of herring. 220t was also landed on the Long Island Shore, and 59t was landed on German Bank. It would have been ideal to have a survey on this week, but it was not able to happen.

Week 41: October 5- October 11

9-10 vessels fished German Bank this week (1594t). Weather conditions started out poor this week, but improved toward the end of the week. On the night of October 6, there were not many fish to be found on German Bank. By the night of the 7th, the situation had greatly improved, with good amounts of herring in the area. The fish were staying deep in the water and were in roe condition. Recordings were not especially good, due to weather conditions. On October 10, ten vessels participated in the 4th survey of German Bank. Some fish was noted on bottom, but there was not the quantity that had been there earlier in the week. The fish were very deep after midnight on the survey night, so they could not be caught. Some of the Captain's felt that they had missed the fish that was there in the middle of the week, and that the fish had spawned and then moved out of the area. Long Island Shore (2140t) and the Grand Manan Banks (1610t) were also very active this week with high landings in both places.

Week 42: October 12- October 14

The 2002-2003 fishing season ended on the 15th of October. Landings this week were not as high as previous weeks. Grand Manan (331t), Long Island Shore (221t), German Bank (153t), and NB Coastal (670t) were the four areas fished this week. The industry wanted to get in one more survey for this quota year, but had to wait until the 20th of October for the 5th survey of German Bank.

Acknowledgements:

A sincere thank you is extended to all captains who provided me with information throughout the fishing season. Thanks to Donna Larkin of South West Seiners Co. Ltd., and Joy Fry of the Atlantic Herring Co-op for all of their help in producing this document. A special note of thanks to Captain Glenn d'Eon for providing me with fishing activity reports throughout the fishing season.

Table 1. Purse seine herring catch (t) and number of slips (landings) by fishing grounds for weeks 1 to 30 (data from MARFIS commercial landings system for Oct. 15, 2002 to Feb. 2004).

Year	Code	Fishing Grounds	Week	1	2	3	4	5	6	7	8	18	19	20	21	22	23	24	25	26	27	28	29	30
2003	1	Grand Manan	Catch t		235		39	99	158		12			103	14		473	347	480	161	1148	722	139	
			No. of Slips		10		2	5	9		1			5	2		17	13	19	6	35	33	4	
	2	Long Island	Catch t										494	1510	1152	590	82	368	149	620	22	212	1177	1057
			No. of Slips										11	41	36	23	3	12	7	20	1	5	48	37
	4	Lurcher	Catch t										300								34	1240	128	
			No. of Slips										11								1	17	2	
	5	Gannet,Dry Ledge	Catch t									35	52						6		3651	1725	391	
			No. of Slips									4	2						1		47	20	7	
	6	Seal Island	Catch t																	1096				
			No. of Slips																	16				
	7	German Bank	Catch t									71	16						80	223	795	99	687	18
			No. of Slips									7	2						1	5	12	2	12	1
	8	Scots Bay	Catch t																				1187	1919
			No. of Slips																				12	33
	10	N.B. Coastal	Catch t	655	301	293	270	78	88	130	25													
			No. of Slips	16	14	13	13	6	5	5	2													
	11	S.W. Grounds	Catch t														14			48			11	
			No. of Slips														1			2			1	
	17	Western Hole	Catch t											55										
			No. of Slips											3										
	20	Offshore Banks	Catch t															722						
			No. of Slips															13						
	99	Unspecified	Catch t																					
			No. of Slips																					
2003 Sum of Catch t				655	536	293	309	177	246	130	37	106	862	1668	1166	590	569	1437	715	2148	5650	3998	3720	2994
2003 Sum of No. of Slips				16	24	13	15	11	14	5	3	11	26	49	38	23	21	38	28	49	96	77	86	71
2004	1	Grand Manan	Catch t	467	172			182																
			No. of Slips	12	7			10																
	10	N.B. Coastal	Catch t	336		40	89	12																
			No. of Slips	6		1	2	1																
	99	Unspecified	Catch t	147																				
			No. of Slips	6																				
2004 Sum of Catch t				950	172	40	89	194																
2004 Sum of No. of Slips				24	7	1	2	11																

Appendix A: Report of Fleet Activity

Table 2. Purse seine herring catch (t) and number of slips (landings) by fishing grounds for weeks 31 to 50 (data from MARFIS commercial landings system for Oct. 15, 2002 to Feb. 2004).

Year	Code	Fishing Grounds	Week	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
2002	1	Grand Manan	Catch t												1339	529	445	382	533	482	406	111	
			No. of Slips												26	16	10	9	6	6	6	2	
	2	Long Island	Catch t													110			78			18	
			No. of Slips													1			1			1	
	10	N.B. Coastal	Catch t												426	986	559	73					
			No. of Slips												6	12	15	1					
2002 Sum of Catch t															1765	1625	1004	455	611	482	406	129	
2002 Sum of No. of Slips															32	29	25	10	7	6	6	3	
2003	1	Grand Manan	Catch t	289	495	361	751	349	551	299	1029	2896	3327	1610	331	114	545	25		99			57
			No. of Slips	10	12	16	25	20	24	10	36	44	61	29	8	4	14	1		1			1
	2	Long Island	Catch t	353	405	90		31	125	406	239	264	220	2140	221			103		352	257		
			No. of Slips	17	13	3		2	5	22	6	6	4	31	4			1		4	5		
	4	Lurcher	Catch t					59				111											
			No. of Slips					1				5											
	5	Gannet,Dry Ledge	Catch t			172	166	55	187	252	178	95											
			No. of Slips			5	4	1	3	3	2	1											
	6	Seal Island	Catch t																				
			No. of Slips																				
	7	German Bank	Catch t	149	387	99	599	3813	3737	5406	3281	307	59	1594	153								
			No. of Slips	2	4	2	11	43	37	64	42	7	1	14	4								
	8	Scots Bay	Catch t	5562	4189	3763	1601	636	339														
			No. of Slips	56	53	46	26	8	3														
	10	N.B. Coastal	Catch t											185	670	509	465	245					
			No. of Slips											5	12	16	8	5					
	11	S.W. Grounds	Catch t																				
			No. of Slips																				
	17	Western Hole	Catch t																				
			No. of Slips																				
	20	Offshore Banks	Catch t																				
			No. of Slips																				
	99	Unspecified	Catch t							74		92	463	555	20	58	404	582	1261	798	118		
			No. of Slips							1		4	17	21	2	1	3	4	10	5	1		
2003 Sum of Catch t				6353	5476	4485	3117	4943	4939	6437	4727	3765	4069	6084	1395	681	1414	955	1261	1249	375		57
2003 Sum of No. of Slips				85	82	72	66	75	72	100	86	67	83	100	30	21	25	11	10	10	6		1

Table 3. Herring mean size (mm) from length frequency purse seine catch samples by fishing grounds and week in 2003.

Average of MEAN_LEN	AREA NAME										
	1	2	4	5	6	7	8	10	11	20	Grand Total
WEEK	Grand Manan	Long Island	Lurcher	Gannet,Dry Ledge	Seal Island	German Bank	Scots Bay	N.B. Coastal	S.W. Grounds	Offshore Banks	
1								167			167
2	185							155			170
3								174			174
4	165							153			159
5	182							161			171
6	176							158			167
7								168			168
8	168							161			164
12								173			173
19	191	227	162								193
20	180	186									183
21	201	203									202
22	191	193									192
23	201	166									184
24	198	194								274	222
25	199	204				267					223
26	188	216			252	253			265		235
27	203	198		276		285					240
28	188	204	259	266		260					235
29	187	217		250		253	288				239
30		219					286				252
31	212	225				239	279				239
32	242	263				250	273				257
33	246	260				247	271				256
34	219			231		253	268				243
35	210	216		202		261	264				231
36	206	211		228		266	257				234
37	195	198				262					218
38	203	208				260					224
39	198	204	209			261					218
40	200	210				192					201
41	190	208				256		199			213
42	235					275		200			237
43	209					259		191			220
44	210							188			199
45		204						178			191
47		202									202
48		239									239
Grand Total	199	211	210	242	252	255	273	173	265	274	218

Appendix A: Report of Fleet Activity

Table 4. Herring mean size (mm) and number of samples collected from length frequency purse seine catch sampling by fishing grounds for weeks 1 to 28 in calendar year 2003.

AREA	NAME	Week	1	2	3	4	5	6	7	8	12	19	20	21	22	23	24	25	26	27	28
1	Grand Manan	Mean Length mm		185		165	182	176		168		191	180	201	191	201	198	199	188	203	188
		No. of Samples		7		1	5	10		1		2	1	2	1	8	11	14	3	17	9
2	Long Island	Mean Length mm										227	186	203	193	166	194	204	216	198	204
		No. of Samples										1	17	13	16	1	6	4	10	1	5
4	Lurcher	Mean Length mm										162									259
		No. of Samples										2									8
5	Gannet,Dry Ledge	Mean Length mm																		276	266
		No. of Samples																		28	12
6	Seal Island	Mean Length mm																	252		
		No. of Samples																	12		
7	German Bank	Mean Length mm																267	253	285	260
		No. of Samples																1	2	6	1
8	Scots Bay	Mean Length mm																			
		No. of Samples																			
10	N.B. Coastal	Mean Length mm	167	155	174	153	161	158	168	161	173										
		No. of Samples	8	14	6	11	6	1	4	1	1										
11	S.W. Grounds	Mean Length mm																	265		
		No. of Samples																	1		
20	Offshore Banks	Mean Length mm															274				
		No. of Samples															13				
Overall Average of Mean Length mm			167	170	174	159	171	167	168	164	173	193	183	202	192	184	222	223	235	240	235
Total Number of Samples			8	21	6	12	11	11	4	2	1	5	18	15	17	9	30	19	28	52	35

Table 5. Herring mean size (mm) and number of samples collected from length frequency purse seine catch sampling by fishing grounds for weeks 29 to 48 in calendar year 2003.

AREA	NAME	Week	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	47	48
1	Grand Manan	Mean Length mm	187		212	242	246	219	210	206	195	203	198	200	190	235	209	210			
		No. of Samples	1		4	5	10	12	9	10	5	15	16	29	5	6	1	8			
2	Long Island	Mean Length mm	217	219	225	263	260		216	211	198	208	204	210	208				204	202	239
		No. of Samples	25	12	8	8	2		2	4	12	4	1	1	5				1	4	5
4	Lurcher	Mean Length mm											209								
		No. of Samples											1								
5	Gannet,Dry Ledge	Mean Length mm	250					231	202	228											
		No. of Samples	2					2	1	1											
6	Seal Island	Mean Length mm																			
		No. of Samples																			
7	German Bank	Mean Length mm	253		239	250	247	253	261	266	262	260	261	192	256	275	259				
		No. of Samples	13		2	6	1	6	33	21	33	17	4	1	8	1	1				
8	Scots Bay	Mean Length mm	288	286	279	273	271	268	264	257											
		No. of Samples	6	15	26	25	25	13	8	3											
10	N.B. Coastal	Mean Length mm													199	200	191	188	178		
		No. of Samples													4	9	10	1	3		
11	S.W. Grounds	Mean Length mm																			
		No. of Samples																			
20	Offshore Banks	Mean Length mm																			
		No. of Samples																			
Overall Average of Mean Length mm			239	252	239	257	256	243	231	234	218	224	218	201	213	237	220	199	191	202	239
Total Number of Samples			47	27	40	44	38	33	53	39	50	36	22	31	22	16	12	9	4	4	5

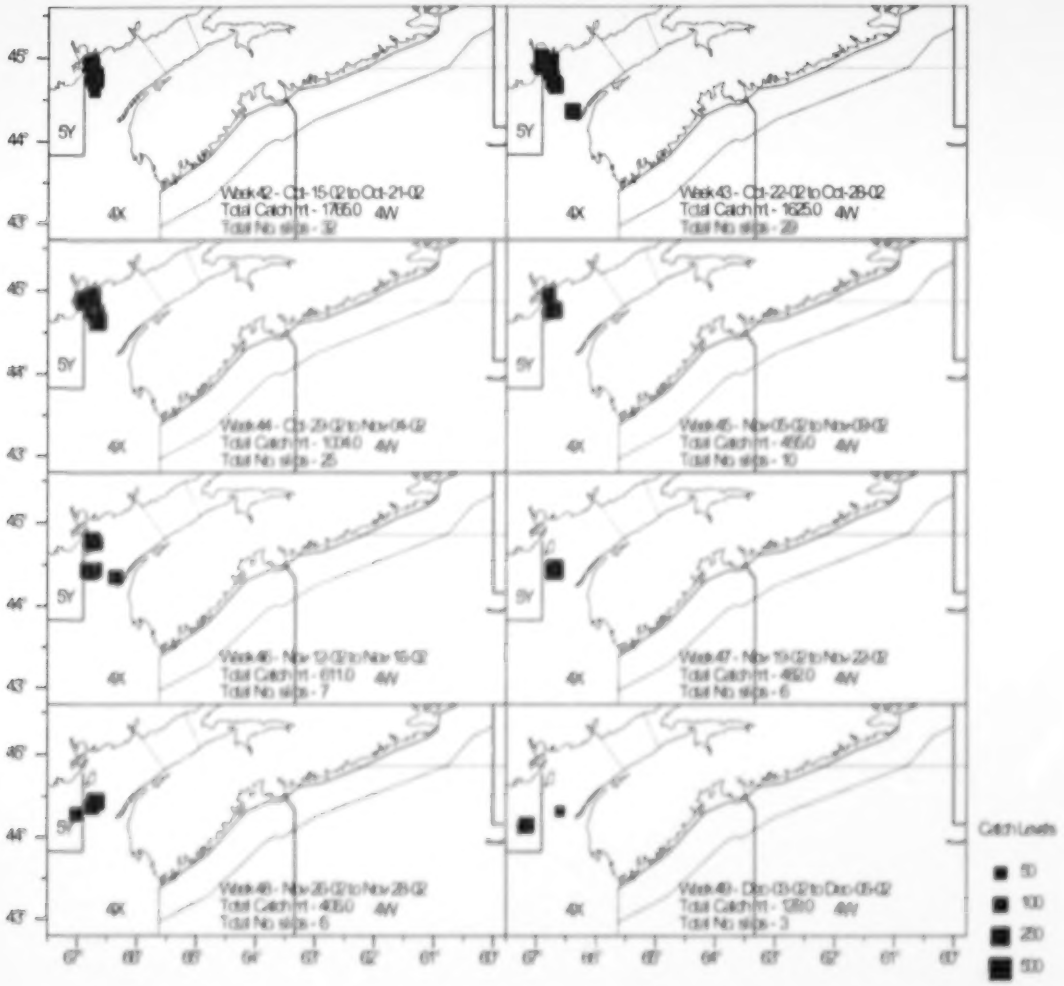

Figure 1. Herring purse seine catches (t) and total number of slips (landings) by week from Oct. 15, 2002 to Dec. 31, 2002 for the 2002-2003 quota year (data from the MARFIS commercial landings system).

Appendix A: Report of Fleet Activity

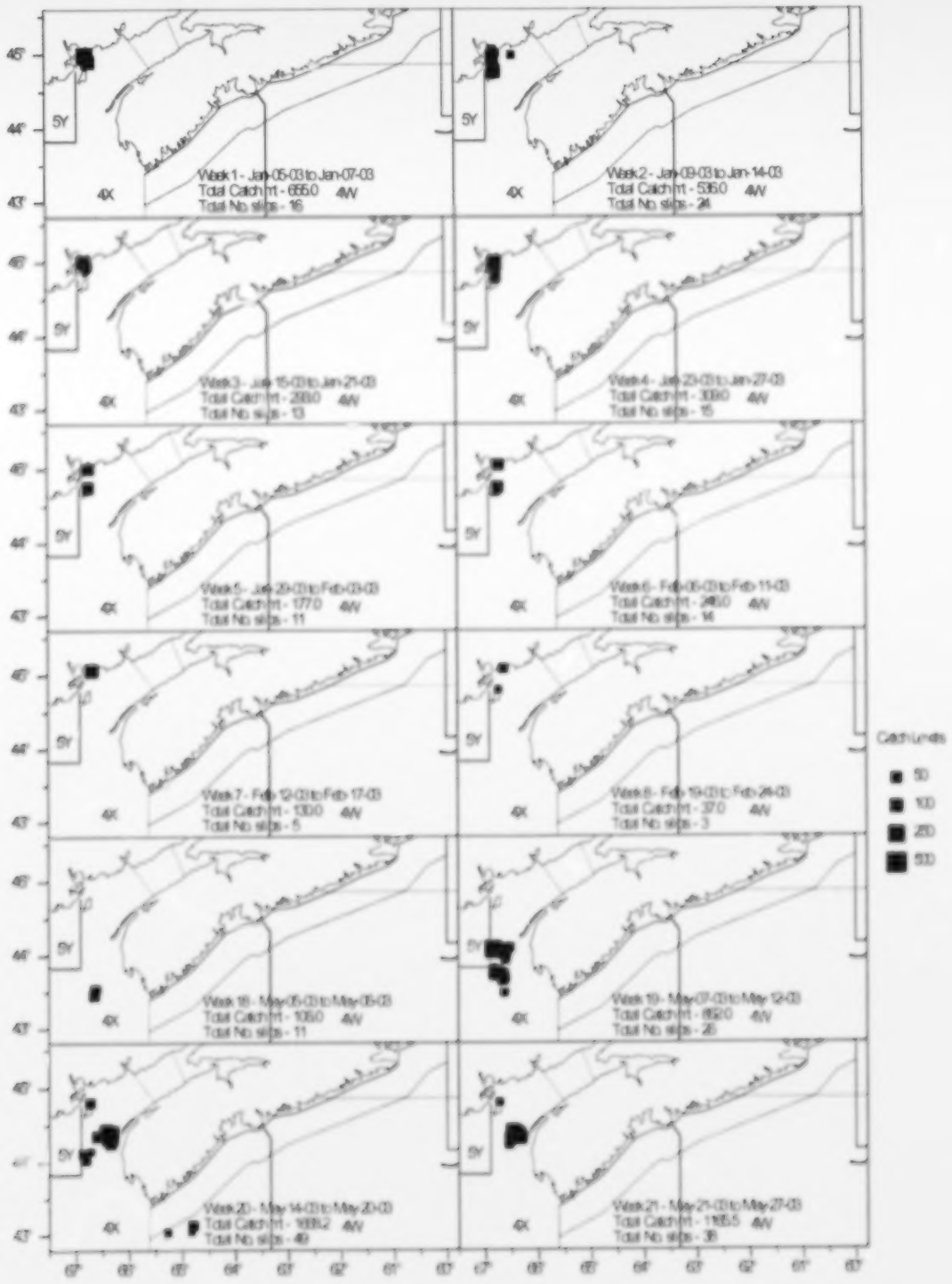
Week 1 - Jan-05-03 to Jan-07-03
Total Catch(t) - 655.0
Total No. slips - 16
Week 2 - Jan-09-03 to Jan-14-03
Total Catch(t) - 535.0
Total No. slips - 24
Week 3 - Jan-15-03 to Jan-21-03
Total Catch(t) - 288.0
Total No. slips - 13
Week 4 - Jan-23-03 to Jan-27-03
Total Catch(t) - 330.0
Total No. slips - 15
Week 5 - Jan-29-03 to Feb-03-03
Total Catch(t) - 177.0
Total No. slips - 11
Week 6 - Feb-05-03 to Feb-11-03
Total Catch(t) - 249.0
Total No. slips - 14
Week 7 - Feb-12-03 to Feb-17-03
Total Catch(t) - 130.0
Total No. slips - 5
Week 8 - Feb-19-03 to Feb-24-03
Total Catch(t) - 37.0
Total No. slips - 3
Week 18 - May-05-03 to May-06-03
Total Catch(t) - 105.0
Total No. slips - 11
Week 19 - May-07-03 to May-12-03
Total Catch(t) - 652.0
Total No. slips - 26
Week 20 - May-14-03 to May-20-03
Total Catch(t) - 1881.2
Total No. slips - 49
Week 21 - May-21-03 to May-27-03
Total Catch(t) - 1185.5
Total No. slips - 36
5Y
4X
Catch units
10
100
250
500

Figure 2. Herring purse seine catches (t) and total number of slips (landings) for weeks 1 to 21 in the 2002-2003 quota year (data from the MARFIS commercial landings system).

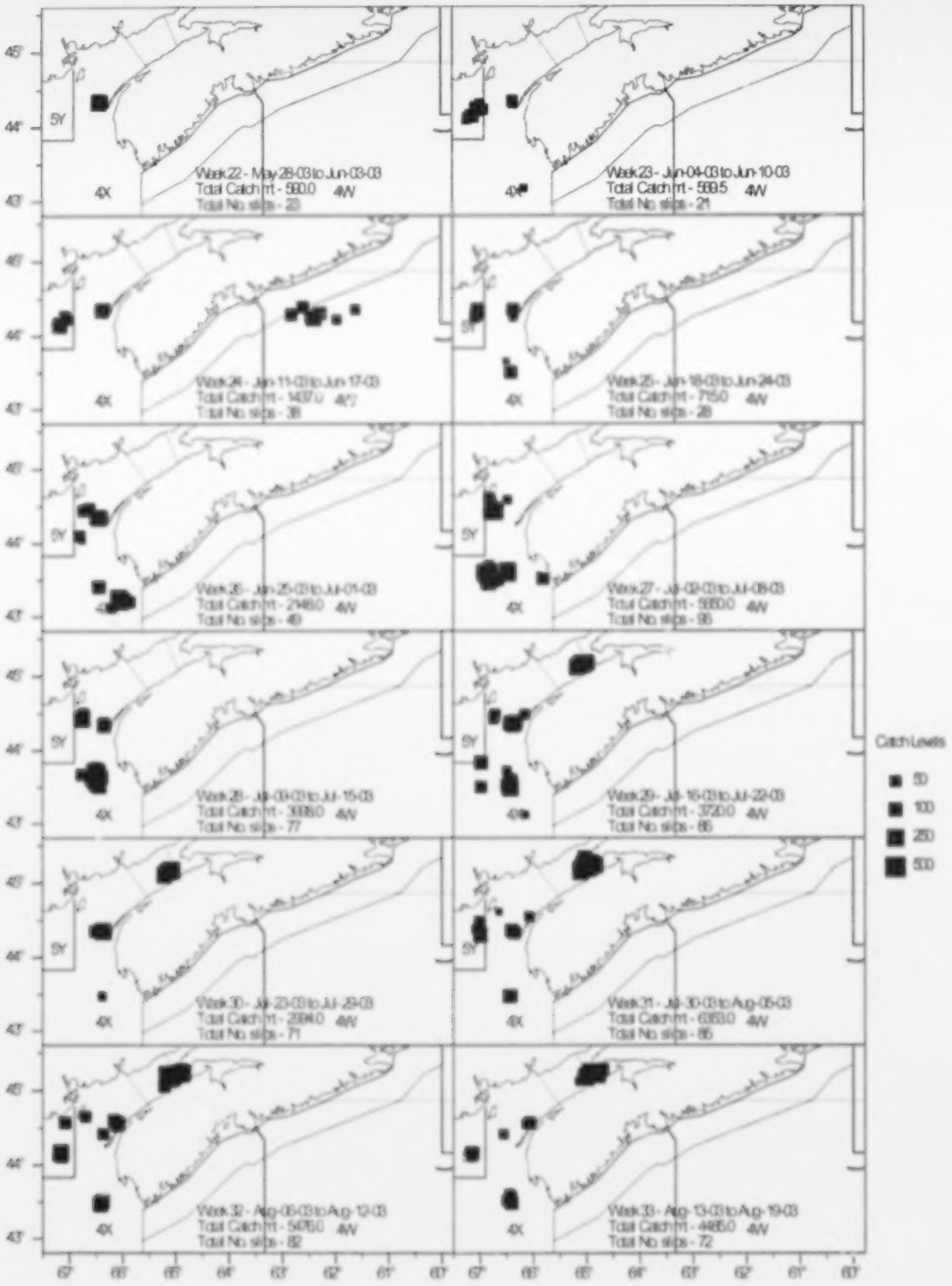
Week 22 - May-28-03 to Jun-03-03
Total Catch mt - 590.0 4W
Total No. slips - 20
Week 23 - Jun-04-03 to Jun-10-03
Total Catch mt - 569.5 4W
Total No. slips - 21
Week 24 - Jun-11-03 to Jun-17-03
Total Catch mt - 1437.0 4W
Total No. slips - 38
Week 25 - Jun-18-03 to Jun-24-03
Total Catch mt - 715.0 4W
Total No. slips - 28
Week 26 - Jun-25-03 to Jul-01-03
Total Catch mt - 2148.0 4W
Total No. slips - 49
Week 27 - Jul-02-03 to Jul-08-03
Total Catch mt - 988.0 4W
Total No. slips - 95
Week 28 - Jul-09-03 to Jul-15-03
Total Catch mt - 3388.0 4W
Total No. slips - 77
Week 29 - Jul-16-03 to Jul-22-03
Total Catch mt - 3720.0 4W
Total No. slips - 86
Week 30 - Jul-23-03 to Jul-29-03
Total Catch mt - 2884.0 4W
Total No. slips - 71
Week 31 - Jul-30-03 to Aug-05-03
Total Catch mt - 6953.0 4W
Total No. slips - 86
Week 32 - Aug-06-03 to Aug-12-03
Total Catch mt - 5476.0 4W
Total No. slips - 82
Week 33 - Aug-13-03 to Aug-19-03
Total Catch mt - 4885.0 4W
Total No. slips - 72
5Y
4X
Catch Levels
50
100
250
500

Figure 3. Herring purse seine catches (t) and total number of slips (landings) for weeks 22 to 33 in the 2002-2003 quota year (data from the MARFIS commercial landings system).

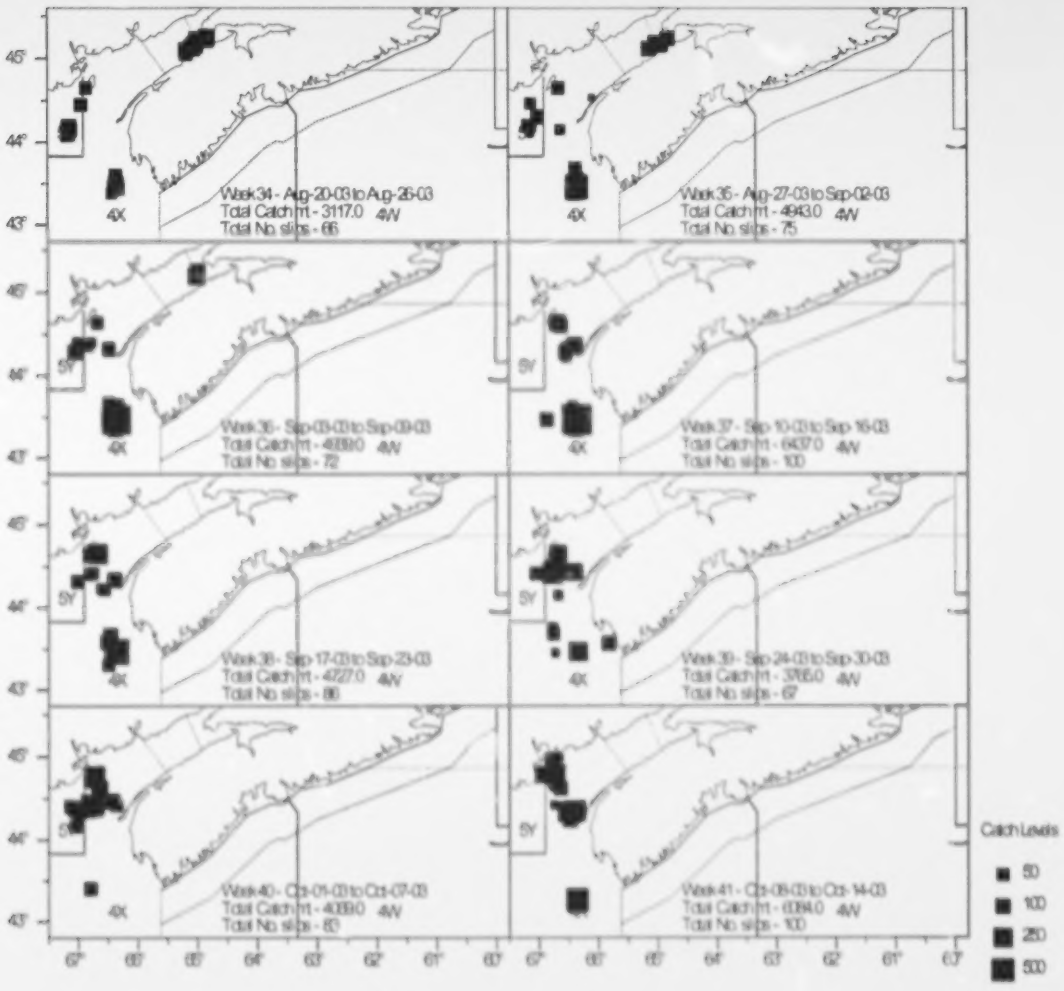
Week 34 - Aug-20-03 to Aug-26-03
Total Catch mt - 3117.0 4W
Total No. slips - 66
Week 35 - Aug-27-03 to Sep-02-03
Total Catch mt - 4943.0 4W
Total No. slips - 75
Week 36 - Sep-03-03 to Sep-09-03
Total Catch mt - 4339.0 4W
Total No. slips - 72
Week 37 - Sep-10-03 to Sep-16-03
Total Catch mt - 6437.0 4W
Total No. slips - 100
Week 38 - Sep-17-03 to Sep-23-03
Total Catch mt - 4727.0 4W
Total No. slips - 86
Week 39 - Sep-24-03 to Sep-30-03
Total Catch mt - 3765.0 4W
Total No. slips - 67
Week 40 - Oct-01-03 to Oct-07-03
Total Catch mt - 4039.0 4W
Total No. slips - 85
Week 41 - Oct-08-03 to Oct-14-03
Total Catch mt - 6384.0 4W
Total No. slips - 100
4X
5Y
Catch Levels
50
100
250
500

Figure 4. Herring purse seine catches (t) and total number of slips (landings) for weeks 34 to 41 in the 2002-2003 quota year (data from the MARFIS commercial landings system).

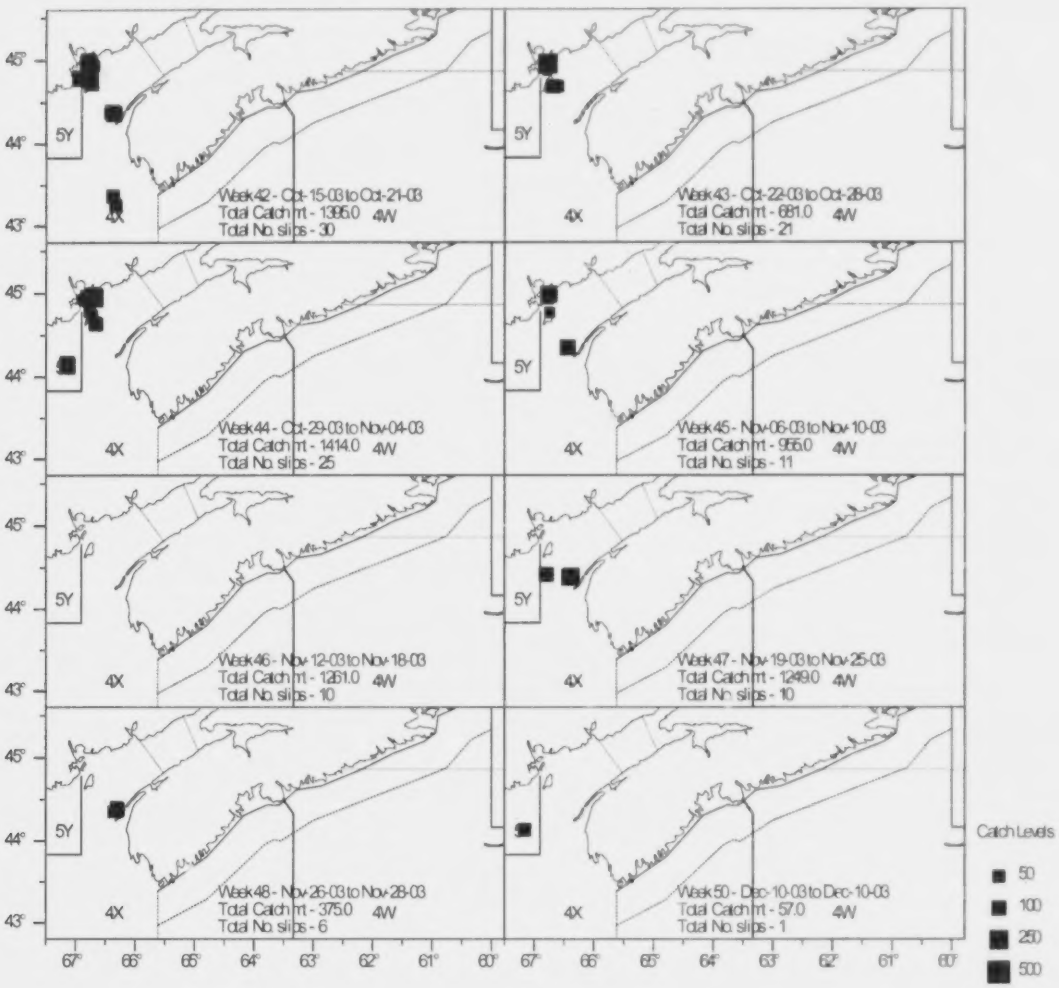

Figure 5. Herring purse seine catches (t) and total number of slips (landings) by week from Oct. 15, 2003 to Dec. 31, 2003 for the 2003-2004 quota year (data from the MARFIS commercial landings system).

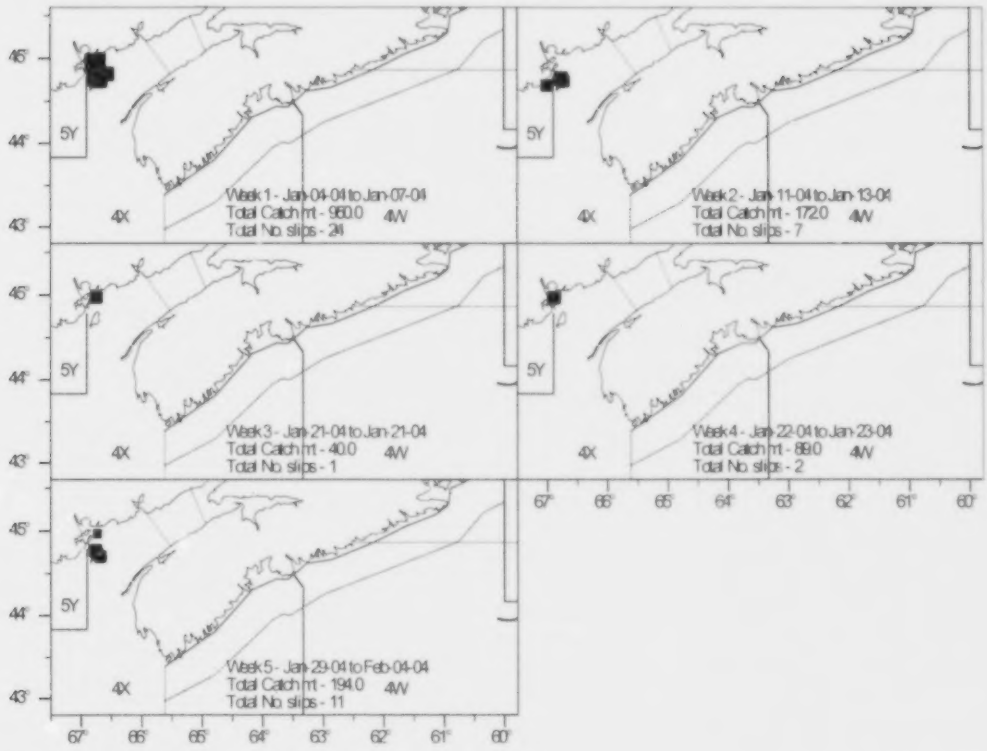

Figure 6. Herring purse seine catches (t) and total number of slips (landings) by week from Jan. 1, 2004 to Feb. 4, 2004 for the 2003-2004 quota year (data from the MARFIS commercial landings system).